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03 First Findings for Canadians Aged 15

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Ressources humaines et Développement des compétences Canada
Statistics Canada
Statistique Canada
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Measuring up: Canadian Results of the OECD PISA Study

The Performance of Canada's Youth in Mathematics, Reading, Science and Problem Solving

2003 First Findings for Canadians Aged 15

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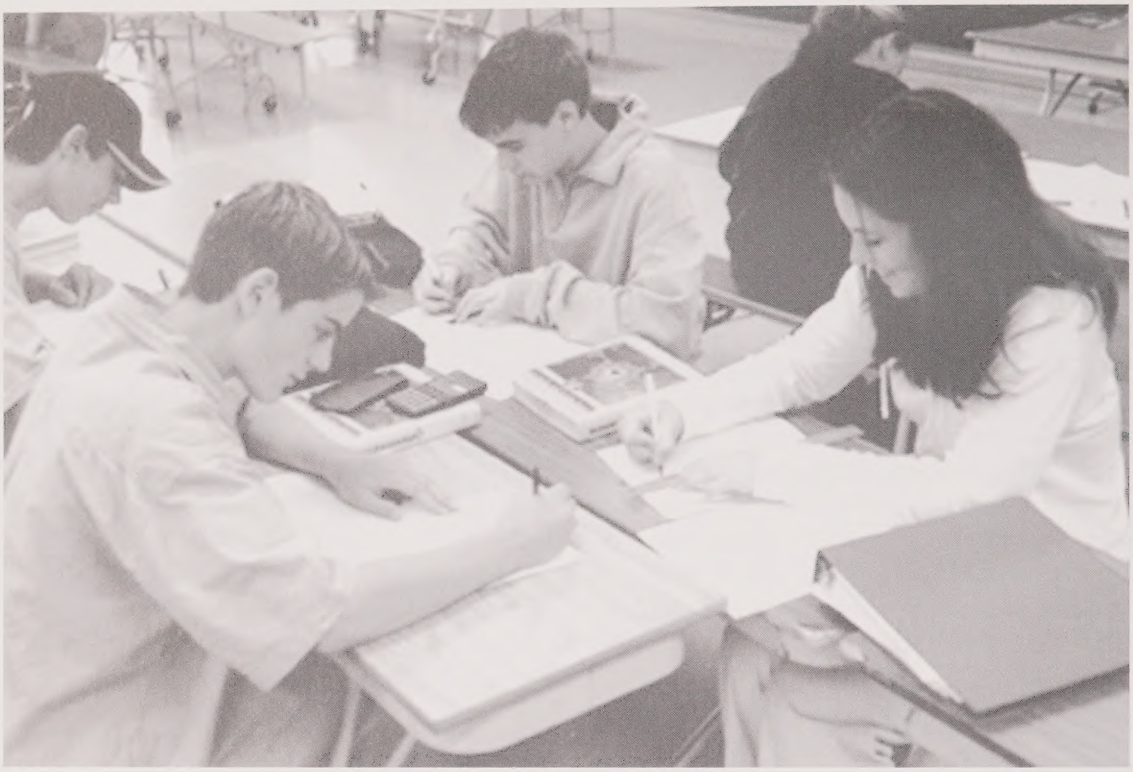

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Introduction

The Programme for International Student Assessment

The Programme for International Student Assessment (PISA) is a collaborative effort among member countries of the Organisation for Economic Co-operation and Development (OECD). PISA is designed to provide policy-oriented international indicators of the skills and knowledge of 15-year-old students[1] and sheds light on a range of factors that contribute to successful students, schools, and education systems. PISA measures skills that are generally recognized as key outcomes of the educational process. They are not, however, the only expected outcomes nor are they solely acquired through education. The assessment focuses on young people's ability to use their knowledge and skills to meet real life challenges. These skills are believed to be prerequisites to efficient learning in adulthood and for full participation in society.

PISA has brought significant public and educational attention to international assessment and studies by generating data to enhance the ability of policy makers to make decisions based on evidence. In Canada, PISA is carried out through a partnership consisting of Human Resources and Skills Development Canada, the Council of Ministers of Education Canada, and Statistics Canada.

PISA began in 2000 and focuses on 15-year-olds' capabilities as they near the end of compulsory education. PISA reports on reading literacy, mathematical literacy, and scientific literacy every three years and provides a more detailed look at each domain in the years when it is the major focus. For example, mathematics was the major domain of PISA in 2003 and as such focused on both overall mathematical literacy and four mathematics sub-domains (*space and shape, change and relationships, quantity, and uncertainty*). Additionally, problem-solving skills were evaluated in PISA 2003. As minor domains in PISA 2003, only single measures of reading and science were available. On the other hand, more detailed information was available on reading and reading sub-domains in 2000 and more information will be available on science and science sub-domains in 2006.

The PISA Assessment Domains

PISA measures three domains: mathematical literacy reading literacy, and scientific literacy. In addition, PISA 2003 measured problem-solving skills. The domains were defined as follows by international experts who agreed that the emphasis should be placed on functional knowledge and skills that allow active participation in society.

***Mathematical literacy* (hereafter referred to as mathematics):**

An individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.

***Reading literacy* (hereafter referred to as reading):**

An individual's capacity to understand, use and reflect on written texts, in order to achieve one's goals, to develop one's knowledge and potential and to participate in society.

Scientific literacy **(hereafter referred to as science):**

An individual's capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.

Problem-solving skills **(hereafter referred to as problem solving):**

An individual's capacity to use cognitive processes to confront and resolve real, cross-disciplinary situations where the solution path is not immediately obvious and where the literacy domains or curricular areas that might be applicable are not within a single domain of mathematics, science or reading. Education systems play a key role in generating the new supply of skills to meet this demand. The skills acquired by the end of compulsory schooling provide the essential foundation upon which we will develop the human capital needed to meet the economic and social challenges of the future. For more information please refer to the PISA 2003 assessment framework.

Why do PISA?

The skills and knowledge that individuals bring to their jobs, to further studies, and to our society, play an important role in determining our economic success and our overall quality of life. The importance of skills and knowledge is expected to continue to grow. The shift from manufacturing to knowledge and information intensive service industries, advances in communication and production technologies, the wide diffusion of information technologies, falling trade barriers, and the globalization of financial markets and markets for products and services have precipitated changes in the skills the present and future economy requires. These include a rising demand for a strong set of foundation skills upon which further learning builds.

Elementary and secondary education systems play a central role in laying a solid base upon which subsequent knowledge and skills can be developed. Students leaving secondary education without a strong foundation may experience difficulty accessing the postsecondary education system and the labour market and they may benefit less when learning opportunities are presented later in life. Without the tools needed to be effective learners throughout their lives, these individuals, with limited skills, risk economic and social marginalization.

Governments in industrialized countries have devoted large portions of their budgets to provide high quality universal elementary and secondary schooling. Despite these investments, there is concern among these governments about the relative effectiveness of their education systems. To address these issues, member governments of the Organisation for Economic Co-operation and Development (OECD) developed a common tool to improve their understanding of what makes young people—and education systems as a whole—successful. This tool is the Programme for International Student Assessment (PISA).

Information gathered through PISA enables a thorough comparative analysis of the skill level of students near the end of their compulsory education. PISA also permits exploration of the ways that skills vary across different social and economic groups and the factors that influence the level and distribution of skills within and among countries.

Why did Canada participate?

Canada's participation in the PISA study stems from many of the same concerns as have been expressed by other participating countries. Canada invests significant public resources in the provision of elementary and secondary education. Canadians are concerned about the quality of education provided to their youth by elementary and secondary schools. How can expenditures be directed to achieve higher levels of skills upon which lifelong learning is founded, and to potentially reduce social inequality in life outcomes?

Canada's economy is also evolving rapidly. For the past two decades, the growth rate of knowledge-intensive occupations has been twice that of other occupations.[22]

Even employees in traditional occupations are expected to upgrade their skills to meet the rising demands of new organisational structures and production technologies. Elementary and secondary education systems play a key role in generating the new supply of skills to meet this demand. The skills acquired by the end of compulsory schooling provide individuals with the essential foundation necessary to further develop human capital.

Questions about educational effectiveness can be partly answered with data on the average performance of Canada's youth. However, two other questions can only be answered by examining the distribution of skills: Who are the students at the lowest levels? Do certain groups or regions appear to be at greater risk? These are important questions because, among other things, skill acquisition during compulsory schooling influences

access to postsecondary education, eventual success in the labour market, and the effectiveness of continuous, lifelong learning.

What is PISA 2003?

Forty-one countries participated in PISA 2003, including all 30 OECD countries[3]. Between 5,000 and 10,000 students aged 15 from at least 150 schools were typically tested in each country. In Canada, approximately 28,000 15-year-olds from about 1,000 schools participated across the ten provinces[4]. The large Canadian sample was required to produce reliable estimates representative of each province, and for both French and English language school systems in Nova Scotia, New Brunswick, Quebec, Ontario, and Manitoba.

The 2003 PISA assessment was administered in schools, during regular school hours in April and May 2003. This assessment was a paper-and-pencil test lasting a total of two hours. Students also completed a 20-minute student background questionnaire providing information about themselves and their home and a 10-minute questionnaire on information technology and communications, while school principals were asked to complete a 20-minute questionnaire about their schools. As part of PISA, national options could also be implemented. Canada chose to add a 20-minute student questionnaire from the Youth in Transition Survey in order to collect more information on 15-year-olds' school experiences, work activities and relationships with others. Additionally, a 30-minute interview was conducted with parents.

Box 1

Overview of PISA 2003

	International	Canada
Participating countries/provinces	• 41 countries	• 10 provinces
Population	• Youth aged 15	• Same; youth born in 1987
Number of participating students	• Between 5,000 and 10,000 per country with some exceptions for a total of close to 272,000 students	• Approximately 28,000 students
Domains	• Major: mathematics • Minor: reading, science and problem solving	• Same

Amount of testing time devoted to domains	• 390 minutes of testing material organized into different combinations of test booklets 120 minutes in length
	  • 210 minutes devoted to mathematics
	  • 60 minutes each devoted to reading, science and problem solving
		• Same

Languages in which the test was administered	• 32 languages	• English and French
International assessment	• Two hours of direct skills assessment through mathematics, reading and science, and problem-solving • Twenty minute contextual questionnaire administered to youth • A school questionnaire administered to school principals	• Same
International options	• Ten-minute optional questionnaire on information technology and communications administered to students • Ten-minute optional questionnaire on educational career administered to students	• Ten-minute optional questionnaire on information technology administered to students administered to students
National options	• Grade-based assessment • Other options were undertaken in a limited number of countries	• Twenty-minute questionnaire on school experiences, work activities and relationships with others administered to students • Thirty-minute interview with parents to collect detailed information on youths' school experiences, parental education and occupation, labour market participation and household income

Objectives and organization of the report

This report provides the first pan-Canadian results of the 2003 PISA assessment of mathematics, reading, science, and problem solving. The information is presented at the national and provincial levels in order to complement the information presented in "Learning for Tomorrow's World – First Results from PISA 2003"[5]. Wherever possible, an attempt has been made to put results into context through comparisons to student peers, internationally and within Canada.

Chapter 1 provides information on the relative performance of Canadian 15-year-old students on the 2003 PISA assessment in mathematics. It looks at the average level of performance on the overall mathematics scale as well as the four mathematics sub-domains, the distribution of achievement scores and proficiency levels in mathematics, gender differences, the differences between English-language and French-language school systems, and comparisons with PISA 2000. Chapter 2 presents information on the mean performance of Canadian students in reading, science and problem solving. Chapters 3 and 4 use PISA 2003 data to explore two themes related to mathematics performance. In Chapter 3, the relationship between student engagement in mathematics, student learning and mathematics performance is explored. Chapter 4 examines the impact of student socio-economic background on mathematics performance. Finally, the major findings and opportunities for further study are discussed in the conclusion.

Notes

1. OECD (1999), *Measuring Student Knowledge and Skills: A New Framework for Assessment*, Paris.
2. Lavoie, Marie and Richard, Roy (June 1998). *Employment in the Knowledge-Based Economy: A Growth Accounting Exercise for Canada*, Ottawa: HRDC Applied Research Branch Research Papers Series R-98-8E.
3. OECD countries include Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States. Partner countries include Brazil, Hong Kong-China, Indonesia, Latvia, Liechtenstein, Macao-China, Russian Federation, Serbia and Montenegro (Ser.), Thailand, Tunisia, Uruguay. Although the United Kingdom participated in PISA 2003, technical problems with its sample prevent its results from being discussed here.
4. No data were collected in the three territories and on Indian Reserves.
5. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.

Chapter 1

The performance of Canadian students in mathematics in an international context

This chapter compares the Canadian results of the PISA 2003 assessment in terms of average scores and proficiency levels. First, the performance of Canadian 15-year-old students is compared to the performance of 15-year-old students from countries that participated in PISA 2003. Second, the results of students' performance in the ten Canadian provinces are analyzed. This information is followed by a comparison between the performance of boys and the performance of girls in Canada and the provinces. Fourth, the performance of students enrolled in English-language and French-language school systems are compared for the five provinces in which the two groups were sampled separately. Finally, the results of PISA 2003 are compared with those of PISA 2000.

Defining mathematics

Mathematics performance as measured by PISA involves more than the ability to perform arithmetic computations. The assessment items also emphasized mathematical knowledge put to functional use in a variety of situations and contexts. This emphasis is reflected in the PISA definition of mathematics:

> An individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.

Mathematics results are presented not only in terms of students' overall mathematics performance but [illegible] for four mathematics sub-domains. These sub-domains are defined in terms of four content areas that cover the range of mathematics 15-year-old students need as [illegible] foundation for life. The OECD defined the four content areas for mathematics as follows:

- *Space and shape* relates to spatial and geometric phenomena and relationships, drawing on the discipline of geometry. It requires looking for similarities and differences when analysing the components of shapes, recognising shapes in different representations and different dimensions as well as understanding the properties of objects and their relative positions.
- *Change and relationships* involves mathematical manifestations of change as well as functional relationships and dependency among variables. It relates most closely to algebra. Mathematical relationships often take the shape of equations or inequalities, but relationships of a more general nature (*e.g.*, equivalence, divisibility, inclusion) are relevant as well. Relationships are given a variety of different representations, including symbolic, algebraic, graphical, tabular, and geometrical representations. Since different representations may serve different purposes and have different properties, translation between representations is often of key importance in dealing with situations and tasks.
- *Quantity* involves numeric phenomena as well as quantitative relationships and patterns. It relates to the understanding of relative size, the recognition of numerical patterns, and the use of numbers to

represent quantities and quantifiable attributes of real-world objects (counts and measures). Furthermore, *quantity* deals with the processing and understanding of numbers that are represented in various ways. An important aspect of dealing with quantity is also *quantitative reasoning*, which involves number sense, representing numbers, understanding the meaning of operations, mental arithmetic, and estimating. The most common curricular branch of mathematics with which it is associated is arithmetic.

- *Uncertainty* involves probabilistic and statistical phenomena and relationships that become increasingly relevant in the information society. These phenomena are the subject of mathematical study in statistics and probability.

The mathematics scores are expressed on a scale with an average of 500 points for the OECD countries[6] and about two-thirds of the students scoring between 400 and 600 (i.e. a standard deviation of 100).

While PISA is not a test of curriculum, the points on the mathematics scale can be interpreted in the context of the school environment. For example, 26 of the 30 OECD countries that participated in PISA 2003 had a sizable number of 15-year-olds in the sample who were enrolled in at least two different, but consecutive grades. For these 26 countries, the OECD analyses revealed that one additional school year corresponds to an increase of 41 score points on the PISA combined mathematics scale[7]. For Canada, the OECD analyses revealed that one additional school year corresponds to an increase of 53 score points on the combined mathematics scale.

One way to summarize student performance and to compare the relative standing of countries is by examining their average test scores. However, simply ranking countries based on their average scores can be misleading because there is a margin of error associated with each score. This margin of error should be taken into account in order to identify whether differences in average scores exist. See text box 'A note on statistical comparisons'.

A note on statistical comparisons

The averages were computed from the scores of random *samples* of students from each country and not from the *population* of students in each country. Consequently it cannot be said with certainty that a *sample* average has the same value as a *population* average that would have been obtained had all 15-year-old students been assessed. Additionally, a degree of error is associated with the scores describing student skills as these scores are estimated based on student responses to test items. We use a statistic, called the *standard error*, to express the degree of uncertainty associated with sampling error and measurement error. The standard error can be used to construct a *confidence interval*, which provides a means of making inferences about the population means and proportions in a manner that reflects the uncertainty associated with sample estimates. A 95% confidence interval is used in this report and represents a range of plus or minus about two standard errors around the sample average. Using this confidence interval it can be inferred that the population mean or proportion would lie within the confidence interval in 95 out of 100 replications of the measurement, using different samples randomly drawn from the same population.

When comparing scores among countries, provinces, or population subgroups the degree of error in each average should be considered in order to determine if averages are different from each other. Standard errors and confidence intervals may be used as the basis for performing these comparative statistical tests. Such tests can identify, with a known probability, whether there are actual differences in the populations being compared.

For example, when an observed difference is *significant at the 0.05 level*, it implies that the probability is less than 0.05 that the observed difference could have occurred because of sampling and measurement error. When comparing countries and provinces, extensive use is made of this type of test to reduce the likelihood that differences due to sampling and measurement errors will be interpreted as real.

Only statistically significant differences at the 0.05 level are noted in this report, unless otherwise stated. This means that the 95% confidence intervals for the averages being compared do not overlap. Due to rounding error, some non-overlapping confidence intervals share an upper or lower limit. All statistical differences are based on un-rounded data.

Canadian students performed well in mathematics

Overall, Canadian students performed well in mathematics, as illustrated in Figures 1.1 to 1.5. Listed in Table 1.1 are the countries that performed significantly better than Canada or equally as well as Canada on the combined mathematics scale as well as the four mathematics sub-domains. The average scores of students in the remaining countries that took part in PISA 2003 were statistically below that of Canada. Among 41 countries, only two countries performed better than Canada on the combined mathematics scale.

Table 1.1

Countries performing better than or about the same as Canada

	Countries performing significantly better* than Canada	Countries performing as well* as Canada
Mathematics – combined scale	Hong Kong-China, Finland	Korea, Netherlands, Liechtenstein, Japan, Belgium, Macao-China, Switzerland
Mathematics – *space and shape*	Hong Kong-China, Japan, Korea, Switzerland, Finland, Liechtenstein, Belgium, Macao-China	Czech Republic, Netherlands, New Zealand, Australia, Austria, Denmark
Mathematics – *change and relationships*	Netherlands, Korea	Finland, Hong Kong-China, Liechtenstein, Japan, Belgium
Mathematics – *quantity*	Finland, Hong Kong-China	Korea, Liechtenstein, Macao-China, Switzerland, Belgium, Netherlands, Czech Republic, Japan
Mathematics – *uncertainty*	Hong Kong-China	Netherlands, Finland, Korea

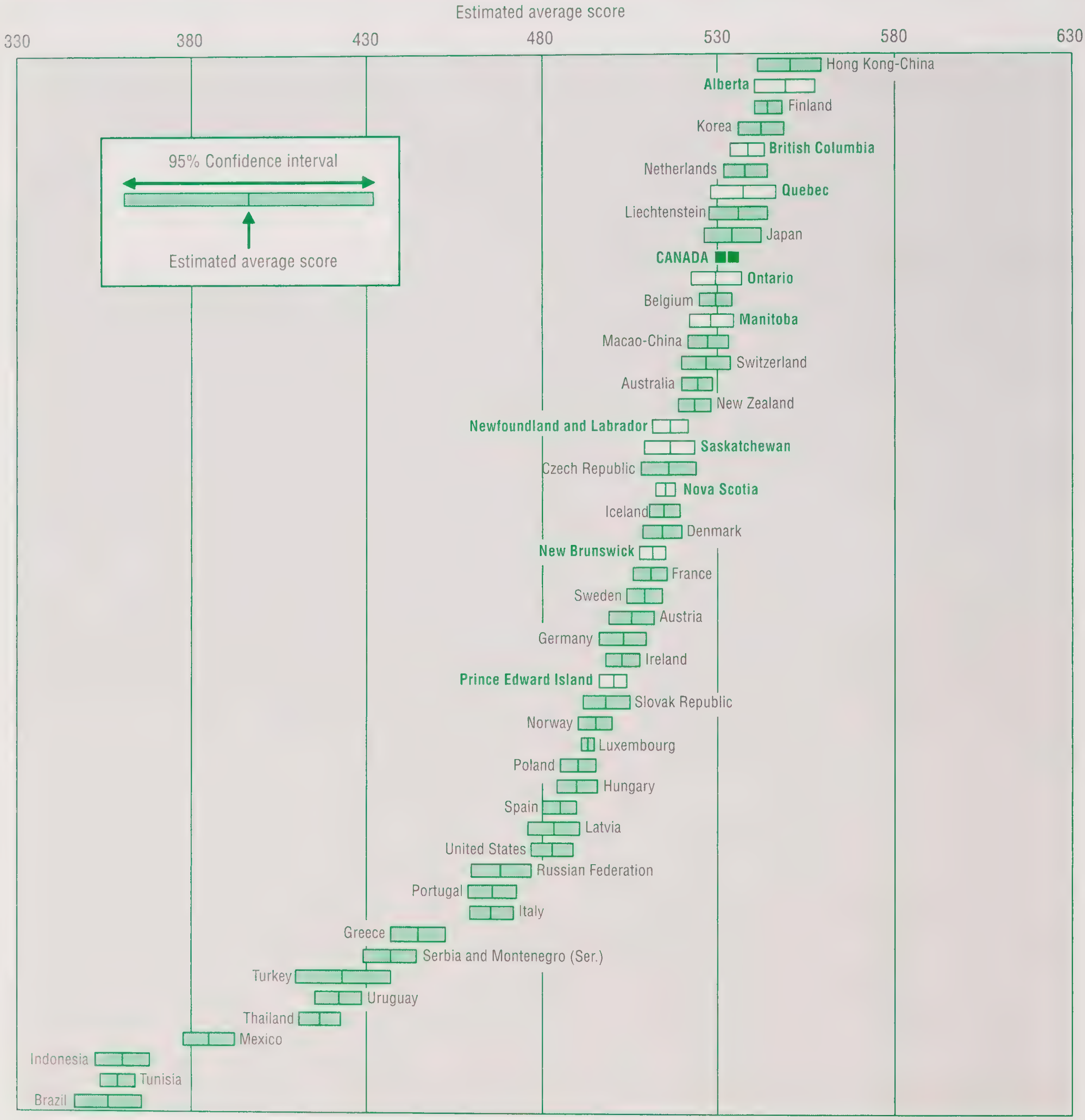
* Differences in scores are statistically significant only when confidence intervals do not overlap. Countries performing about the same as Canada have a confidence interval that overlaps that of Canada's.

Canadian students also performed well in the mathematics sub-domains (Figure 1.2 to Figure 1.5; Table 1.1). Only one country performed significantly better than Canada in the *uncertainty* sub-domain, while students from two countries performed significantly better than Canadian students in the *quantity*, and *change and relationships* sub-domains. Eight countries performed significantly better than Canadian students in the *space and shape* sub-domain.

Further examination of the performance of Canadian students in the four mathematics sub-domains provides insight into the relative strengths and weaknesses of Canadian students. By comparing Canada's relative performance across the four sub-domains, the results show that the strengths of Canada's 15-year-old students are in the areas of *change and relationships*, *quantity* and *uncertainty*, while their relative weakness is in the area of *space and shape*.

Figure 1.1

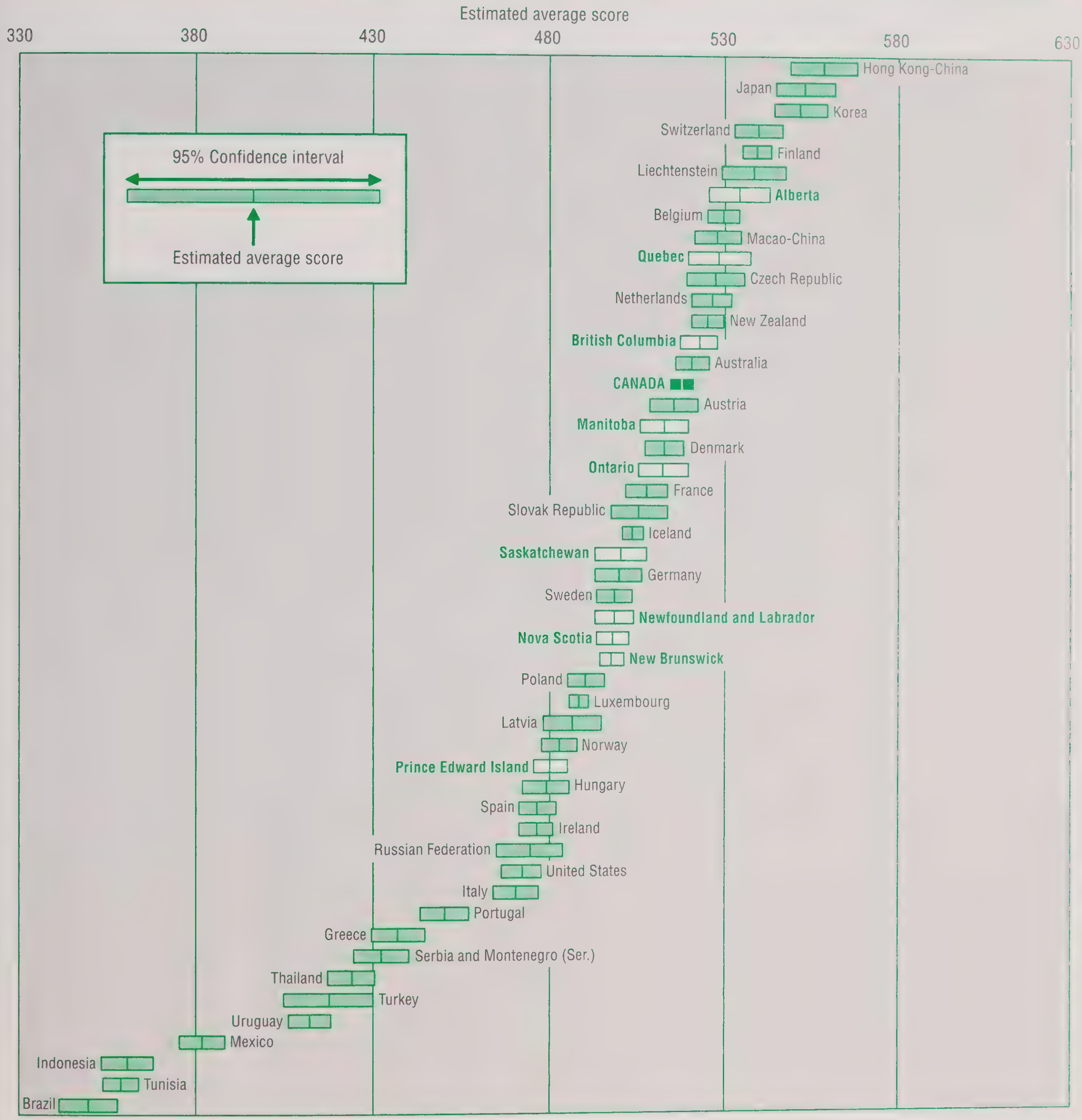
Estimated average scores and confidence intervals for provinces and countries: COMBINED MATHEMATICS



Note: The OECD average is 500 with a standard error of 0.6.

Figure 1.2

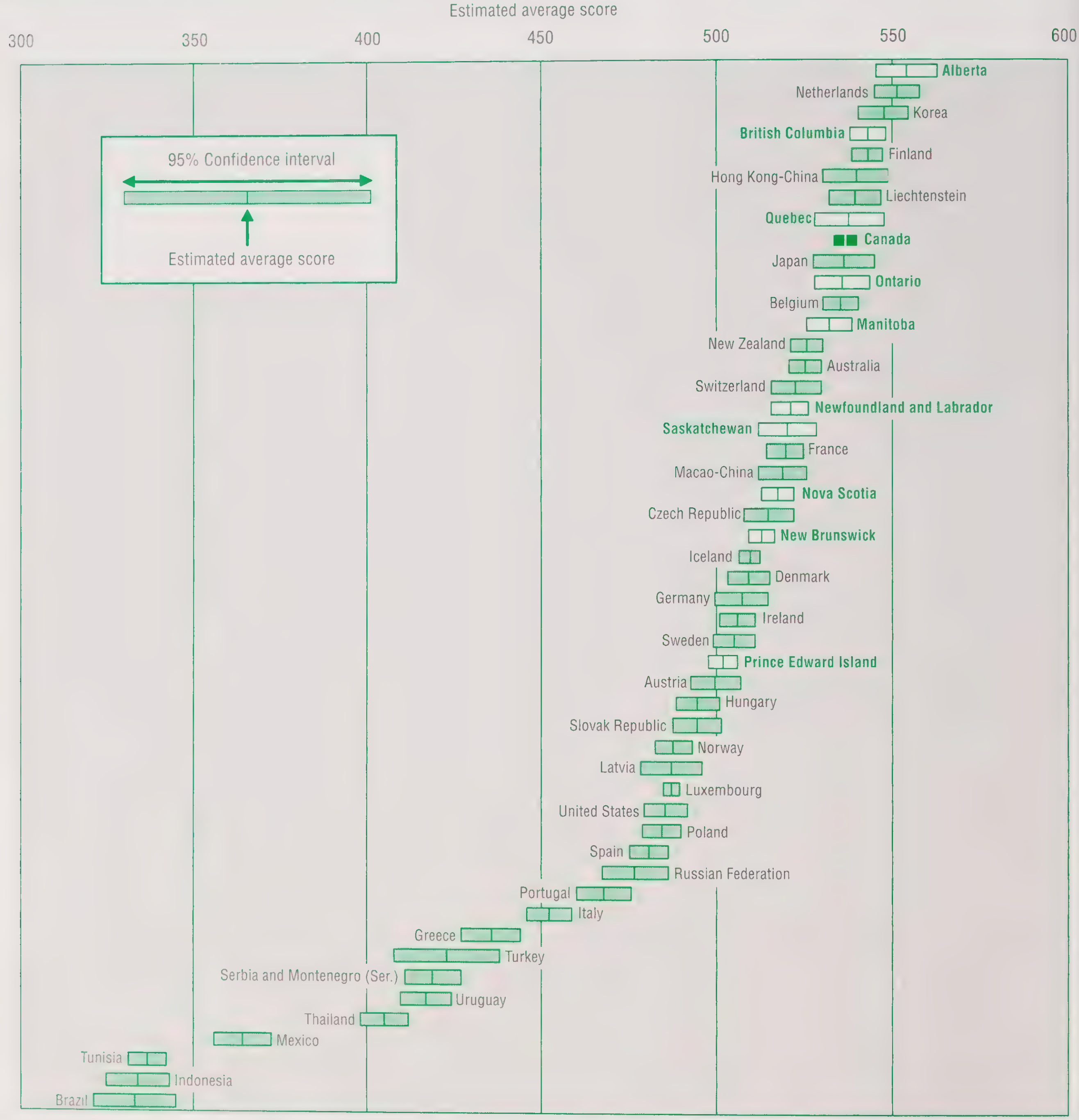
Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS *space and shape*



Note: The OECD average is 496 with a standard error of 0.7.

Figure 1.3

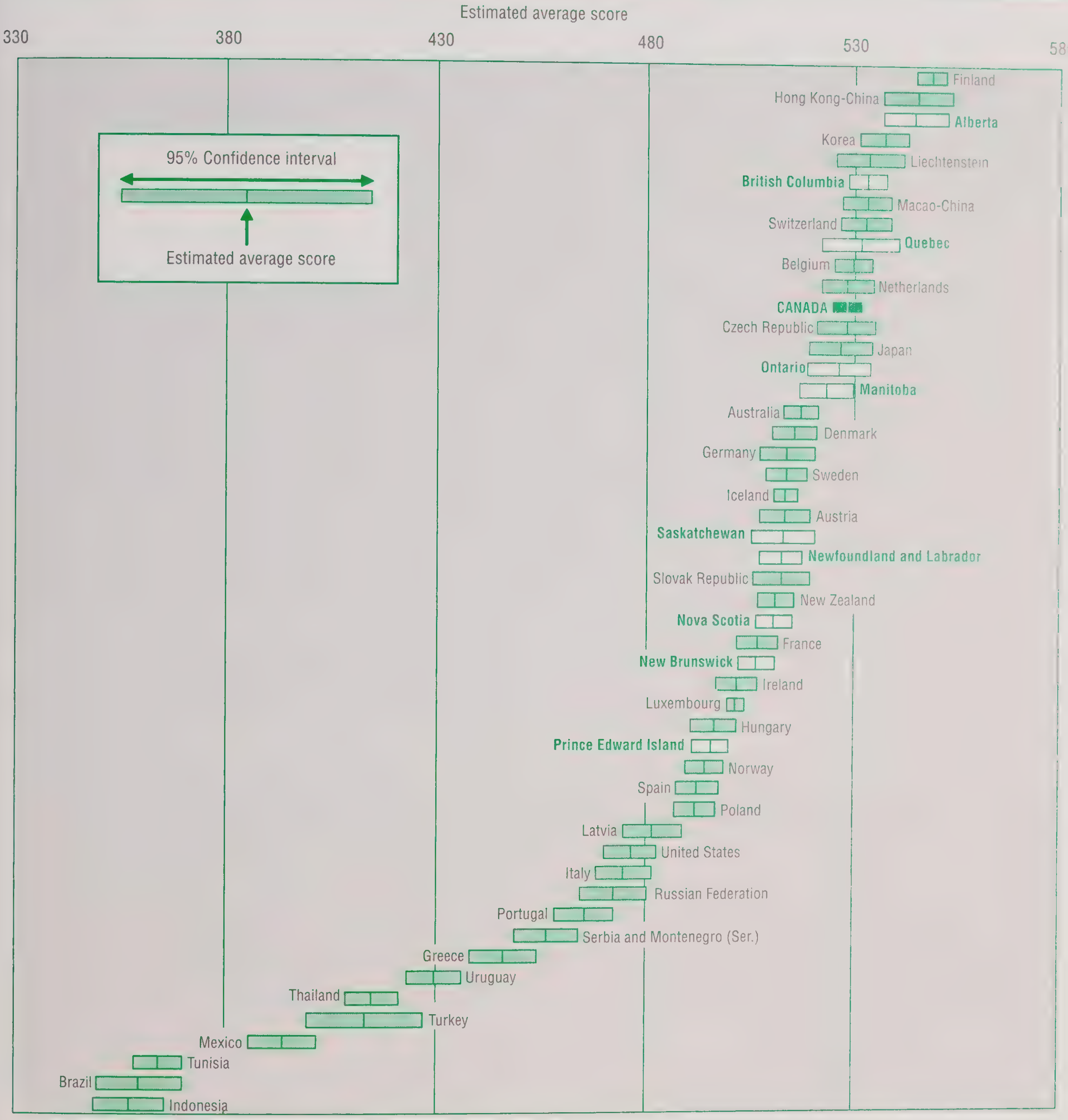
Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS *change and relationships*



Note: The OECD average is 499 with a standard error of 0.7.

Figure 1.4

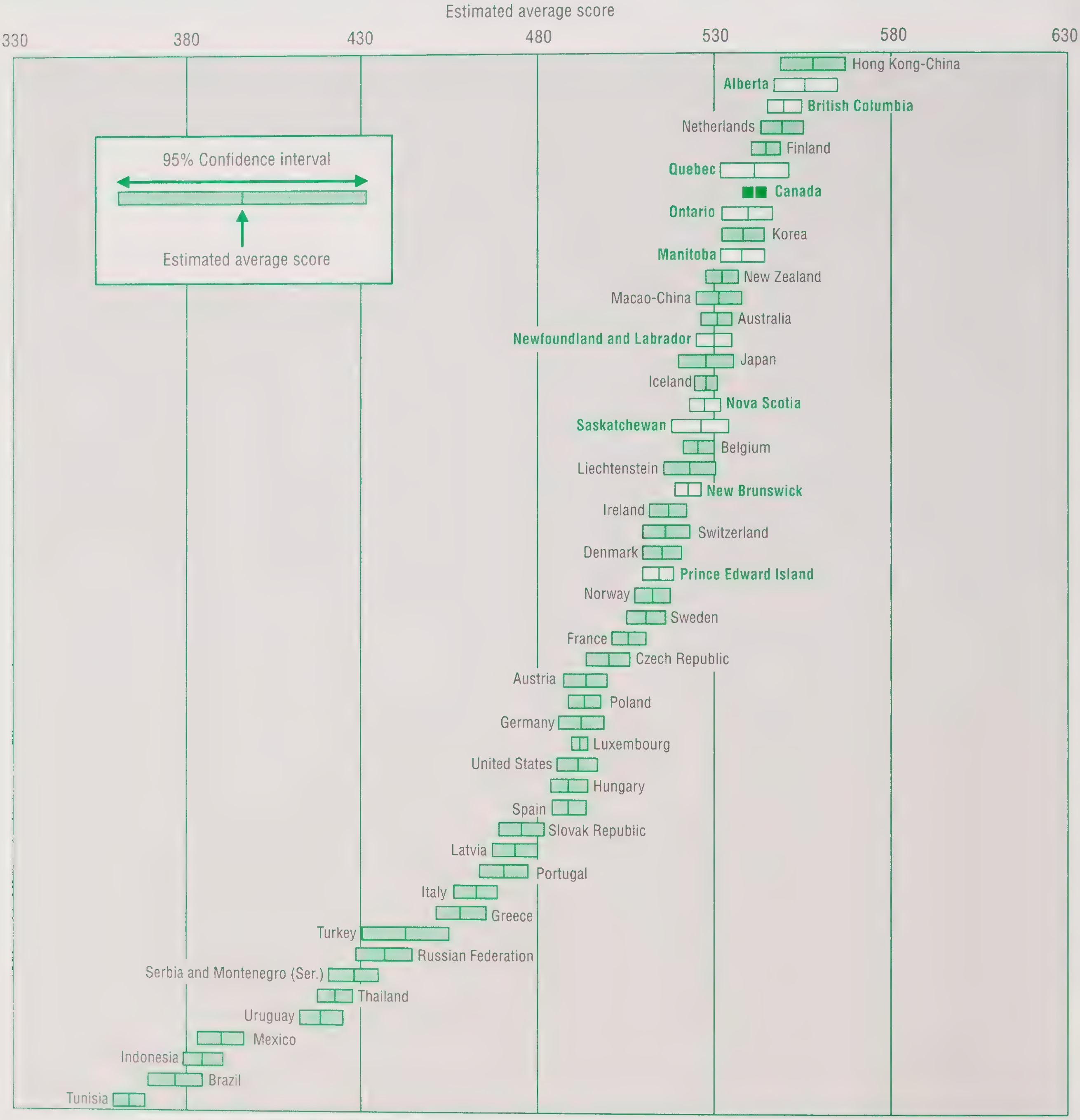
Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS *quantity*



Note: The OECD average is 501 with a standard error of 0.6.

Figure 1.5

Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS *uncertainty*



Note: The OECD average is 502 with a standard error of 0.6.

Provincial results

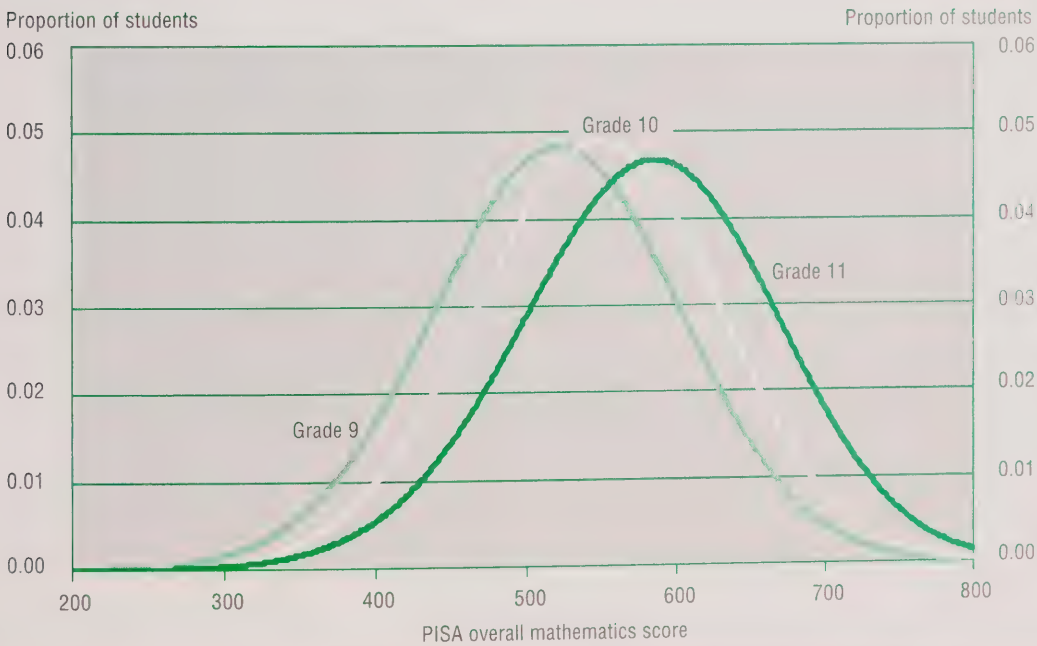
Most provinces performed well in mathematics (Figures 1.1 to 1.5). All provinces performed at or above the OECD mean in the combined mathematics scale and mathematics sub-scale with one exception: Prince Edward Island performed below the OECD mean in the *space and shape* sub-domain. Several provinces performed as well as the top-ranked countries. For example, on the combined mathematics scale the performance of students in Alberta, Quebec and British Columbia compared favourably with the performance of students in Hong Kong-China.

A note on interpreting provincial differences

Although PISA measures skills beyond the school curriculum, most mathematics skills are learned in school. Therefore, students in higher grades may have an advantage in mathematics simply because they have been exposed to more advanced topics. The figure below illustrates the differences in performance between 15-year-old Canadian students in grades 9, 10 and 11 who had not repeated any grades. As expected, the performance of students increased with increasing grade level, although there is substantial overlap among the grades.

Most students born in 1987 were in grade 10 in 2003. However, provincial educational policies on age of enrolment and grade repetition result in differences among the proportions of 15-year-olds enrolled in higher or lower grades. Quebec, for example, has a higher proportion of students from the 1987 cohort in grade 9 than other provinces. Interpretation of provincial differences in performance should consider that this report describes the performance of all 15-year-olds as is the intent of PISA and not the performance of 15-year-olds by grade.

Distribution of overall mathematics score by grade level, Canadian 15-year-olds



Provinces generally fall into one of three groups when compared to the Canadian averages (Table 1.2). The average performance of students in Alberta was significantly above the Canadian average for combined mathematics and the four mathematics sub-domains. Students in British Columbia, Manitoba, Quebec, and Ontario performed about the same as the Canadian average with one exception: students in British Columbia performed above the Canadian average in *uncertainty*.

Students in Newfoundland and Labrador, Saskatchewan, Nova Scotia, New Brunswick and Prince Edward Island performed significantly lower than the Canadian average across all mathematics scales.

Table 1.2

Provincial results in mathematics in relation to the Canadian average

	Provinces performing significantly better* than the Canadian average	Provinces performing as well* as the Canadian average	Provinces performing significantly lower* than the Canadian average
Mathematics – combined scale	Alberta	Quebec, Ontario, Manitoba, British Columbia	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan
Mathematics – *space and shape*	Alberta	Quebec, Ontario, Manitoba, British Columbia	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan
Mathematics – *change and* relationships	Alberta	Quebec, Ontario, Manitoba, British Columbia	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan
Mathematics – *quantity*	Alberta	Quebec, Ontario, Manitoba, British Columbia	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan
Mathematics –*uncertainty*	Alberta, British Columbia	Quebec, Ontario, Manitoba	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan

Differences in scores are statistically significant only when confidence intervals do not overlap. Provinces performing about the same as Canada have a confidence interval that overlaps with that of Canada's. Provinces within each cell are ordered from east to west.

Mathematics skill levels

The average scores reported in the previous section provide a useful but limited way of comparing performance of different groups of students. Another way to look at performance is to examine the proportions of students who can accomplish tasks at various proficiency or skill levels. This kind of analysis allows a further breakdown of average scores and an examination of groups of students who show similar abilities. In PISA, mathematics skill is a continuum – that is, mathematics skill is not something a student has or does not have, but rather every 15-year-old shows a certain level of mathematics skill. The mathematics skill or proficiency levels used in PISA 2003 are described in the text box 'Mathematics Proficiency levels'.

Figure 1.6 (based on data from Table B1.7) shows the distribution of students by skill level by country, and includes the Canadian provinces. Results for countries and provinces are presented in descending order according to the proportion of the 15-year-olds who performed at level 2 or higher.

Mathematics proficiency levels

Mathematics achievement was divided into six proficiency levels representing a group of tasks of increasing difficulty, with Level 6 as the highest and Level 1 as the lowest. Students performing below Level 1 (mathematics score below 359) are not able to show routinely the most basic type of knowledge and skills that PISA seeks to measure. Such students have serious difficulties in using mathematical literacy as a tool to advance their knowledge and skills in other areas. Placement at this level does not mean that these students have no mathematics skills. Most of these students are able to correctly complete some of the PISA items. Their pattern of responses to the assessment is such that they would be expected to solve less than half of the tasks from a test composed of only Level 1 items.

In PISA, students were assigned to a proficiency level based on their probability of answering correctly the majority of items in that range of difficulty. A student at a given level could be assumed to be able to correctly answer questions at all lower levels. To help in interpretation, these levels were linked to specific score ranges on the original scale. Below is a description of the abilities associated with each proficiency level. (Source: Organisation for Economic Cooperation and Development, Programme for International Student Assessment, PISA, 2003).

Level 6 (score above 668)

At Level 6 students can conceptualise, generalise, and utilise information based on their investigations, and modelling of complex problem situations. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understanding along with a mastery of symbolic and formal mathematical operations and relationships to develop new approaches and strategies for attacking novel situations. Students at this level can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situations.

Level 5 (score from 607 to 668)

At Level 5 students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare, and evaluate appropriate problem solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insight pertaining to these situations. They can reflect on their actions and formulate and communicate their interpretations and reasoning.

Level 4 (score from 545 to 606)

At Level 4 students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic ones, linking them directly to aspects of real-world situations. Students at this level can utilise well-developed skills and reason flexibly, with some insight, in these contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments, and actions.

Level 3 (score from 483 to 544)

At Level 3 students can execute clearly described procedures, including those that require sequential decisions. They can select and apply simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They can develop short communications reporting their interpretations, results, and reasoning.

Level 2 (score from 421 to 482)

At Level 2 students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures, or conventions. They are capable of direct reasoning and of making literal interpretations of the results.

Level 1 (score from 359 to 420)

At Level 1 students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are obvious and follow immediately from the given stimuli.

Figure 1.6

Percentage of students at each level of proficiency on the combined mathematics scale

Using these proficiency levels, students with very high and very low levels of proficiency can be identified. Listed in Table 1.3 are the percentages of students who performed at Level 1 or below and the percentages of students who performed at Level 5 or above for each country and the ten provinces.

The lower group includes students who would have great difficulty continuing studies in mathematics and in daily life activities involving the application of mathematics skills. In contrast, the students in the upper group are likely to be well qualified to do so.

Compared to the OECD average, a significantly smaller proportion of Canadian students performed at Level 1 or below in mathematics. The Canadian proportion at Level 1 or below was approximately half the proportion of the OECD average (10% versus 21% respectively). Only Finland had a significantly smaller proportion of students at Level 1 or below than Canada.

In contrast, a significantly higher proportion of Canadian students performed at Level 5 or above in mathematics. The OECD average was approximately 15%, five percentage points lower than the average for Canada. Four countries (Hong Kong-China, Belgium, Liechtenstein and the Netherlands) had significantly greater percentages of students with higher skills than Canada.

Turning to the provinces, the percentages [illegible] students who performed at Level 1 or below on the combined mathematics scale were, with the exception of New Brunswick and Prince Edward Island. similar to the percentage for Canada. The percentages of students in New Brunswick performing at Level 1 or below (1[illegible] were significantly higher than the Canadian percentage performing at Level 1 or below but lower than the percentage observed for the OECD average. [illegible] percentages of students in Prince Edward [illegible] performing at Level 1 or below (18%) were [illegible] higher than the Canadian percentage performing at [illegible] 1 or below and statistically the same as th[illegible] observed for the OECD average.

The proportion of students in Alberta at Lev[illegible] or above (27%) was significantly greater th[illegible] Canadian percentage (20%). The proportion of stud[illegible] in Quebec, British Columbia, Manitoba, and On[illegible] who performed at Levels 5 or higher were com[illegible] to the proportion for Canada.

Lower percentages of students in Newfoun[illegible] and Labrador, Prince Edward Island, Nova Scoti[illegible] Brunswick and Saskatchewan performed at [illegible] above compared to the Canadian percentage (Tal[illegible] However, with the exception of Prince Edward [illegible] the provincial percentages were statistically th[illegible] the OECD average.

Table 1.3

Percentage of students with high level skills in mathematics and low level skills in mathematics, by country and province

Percentage of students with low level skills (Level 1 or below)

Country and province	%
Finland	7
Alberta	**7**
British Columbia	**9**
Korea	10
Ontario	**10**
Canada	**10**
Hong Kong-China	10
Manitoba	**11**
Quebec	**11**
Netherlands	11
Macao-China	11
Liechtenstein	12
Newfoundland and Labrador	**13**
Japan	13
Nova Scotia	**14**
Saskatchewan	**14**
Australia	14
New Brunswick	**14**
Switzerland	15
Iceland	15
New Zealand	15
Denmark	15
Belgium	16
Czech Republic	17
France	17
Ireland	17
Sweden	17
Prince Edward Island	**18**
Austria	19
Slovak Republic	20
OECD average	21
Norway	21
Germany	22
Luxembourg	22
Poland	22
Spain	23
Hungary	23
Latvia	24
United States	26
Portugal	30
Russian Federation	30
Italy	32
Greece	39
Serbia and Montenegro (Ser.)	42
Uruguay	48
Turkey	52
Thailand	54
Mexico	66
Brazil	75
Tunisia	78
Indonesia	78

Percentage of students with high level skills (Level 5 or above)

Country and province	%
Hong Kong-China	31
Alberta	**27**
Belgium	26
Liechtenstein	26
Netherlands	26
Korea	25
Japan	24
Quebec	**24**
Finland	23
British Columbia	**22**
Switzerland	21
New Zealand	21
Canada	**20**
Australia	20
Manitoba	**19**
Macao-China	19
Czech Republic	18
Ontario	**18**
Germany	16
Denmark	16
Sweden	16
OECD average	15
Iceland	15
France	15
Saskatchewan	**15**
Nova Scotia	**14**
Austria	14
Newfoundland and Labrador	**14**
New Brunswick	**14**
Slovak Republic	13
Norway	11
Ireland	11
Luxembourg	11
Hungary	11
Prince Edward Island	**10**
United States	10
Poland	10
Latvia	8
Spain	8
Russian Federation	7
Italy	7
Turkey	5
Portugal	5
Greece	4
Uruguay	3
Serbia and Montenegro (Ser.)	2
Thailand	2
Brazil	1
Mexico	0
Indonesia	0
Tunisia	0

Percentage significantly higher than the Canadian percentage

Percentage not significantly different from the Canadian percentage

Percentage significantly lower than the Canadian percentage

Provincial variation in mathematics performance

The performance of Canada and the provinces that participated in PISA 2003 was first described in terms of the average performance. This is a measure of central tendency around which the majority of students score. However, as just seen with the proficiency levels, there is variability among the students, and the amount of variability differed by province. The amount of variability can be assessed more directly by examining the variance of the scores. The concept of variance is described in more detail in text box 'A note on variation'. What is important to note here is that the greater the variance, the more variable the performance of the students. When the variance has a small value, there is small variation in performance and the scores of the students are similar. Conversely, when the variance has a large value, there is more variation in performance and the scores of the students differ more widely.

A note on variation

When looking at a group of students on a characteristic such as mathematics performance, it is obvious that not all students have the same test score. In fact, very few people have the same scores. Furthermore, the differences among scores are greater in some populations than in other populations. One statistic used to summarize and describe the differences between members of a population is called *variance*.

The statistical estimate of variance describes the average squared difference between each person's score and the average score. A small estimate of variance indicates that members of the population tend to be similar, while a large estimate of variance indicates that members of populations tend to be different from each other. Sometimes the term *standard deviation* is also used to describe difference between people in a population. The standard deviation is the square root of the variance.

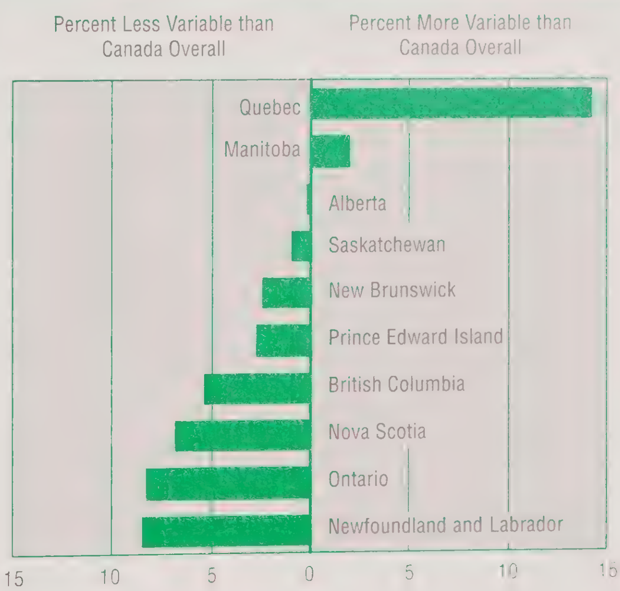
Figure 1.7 shows how much variance there was in student performance in each province relative to the variance in performance for Canada as a whole. The provinces can be divided into three groups based on whether they have more, the same, or less variation in student performance than Canada as a whole.

The first group contains just Quebec, which had the greatest variance among the students' combined mathematics score. The second group contains the provinces with variance similar in value to the variance for Canada: Manitoba, Alberta, Saskatchewan, New Brunswick and Prince Edward Island. The third group contains the provinces in which the variance of the students' scores was less than the variance for Canada: British Columbia, Nova Scotia, Ontario, and Newfoundland and Labrador.

There was not a clear relationship between the rank of provinces based on average performance on the combined mathematics and in the variance of the score. For example, the performance of students in Alberta and Quebec was above average. However, while the variance among the student scores in Quebec was above the variance for Canada, the variance among student scores in Alberta was the same as the variance for Canada. While British Columbia also had above average performance in mathematics, the variance among the scores was below the variance for Canada.

Figure 1.7

Variance in mathematics performance: combined mathematics scale



How does the performance of boys and girls compare?

Parents and policy makers are interested in comparing the performance of boys and girls in mathematics. This issue has been examined in the previous PISA assessment. For example, in PISA 2000 Canada was one of only three countries (France and Germany) where gender differences in mathematics performance were significant[8].

In PISA 2003, boys performed significantly better than girls on the combined mathematics scale in 27 participating countries, including Canada[9]. However, the magnitude of these gender differences was generally small. In Canada, boys outperformed girls by an average of eleven points, which is the same as the OECD average of eleven points (which represents about one-sixth of a proficiency level). No gender differences were observed in 12 countries and in one country (Iceland) girls performed significantly better than boys (Appendix Table B1.8).

As shown in Table 1.4, gender differences were observed in seven of the ten provinces on the combined mathematics scale. Boys performed significantly better than girls in Newfoundland and Labrador, Nova Scotia, New Brunswick, Ontario, Manitoba, Alberta and British Columbia. No significant gender differences were observed in Prince Edward Island, Quebec, or Saskatchewan.

For Canada overall, as well as for many OECD countries, gender differences in mathematics performance were also observed across the four mathematics sub-domains to varying degrees. Gender differences were most pronounced on the *space and shape* scale and least pronounced on the *quantity* scale (Appendix Tables B1.9-B1.12). Canada was one among eleven countries (Denmark, Greece, Ireland, Korea, Luxemburg, New Zealand, Portugal, the Slovak Republic, Macao-China and Tunisia) where gender differences were significant across all four mathematics content areas. However, these gender differences tended to be much smaller than those observed in the area of reading in PISA 2000.

As shown in Table 1.4, gender differences were also observed to varying degrees among the provinces across the four sub-domains. No gender differences were observed among the provinces on *quantity*. On the other hand, boys performed significantly higher than girls across seven provinces in *change and relationships* and across eight provinces in *space and shape* and *uncertainty*.

Table 1.4

Summary of gender differences for Canada and the provinces

	Boys performed significantly better* than girls	No significant differences existed between boys and girls
Mathematics – combined scale	**Canada** Newfoundland and Labrador, Nova Scotia, New Brunswick, Ontario, Manitoba, Alberta, British Columbia	Prince Edward Island, Quebec, Saskatchewan
Mathematics – *space and shape*	**Canada,** Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta, British Columbia	Prince, Edward Island, Saskatchewan
Mathematics – *change and relationships*	**Canada** Newfoundland and Labrador, Nova Scotia, New Brunswick, Ontario, Manitoba, Alberta, British Columbia	Prince Edward Island, Quebec, Saskatchewan
Mathematics – *quantity*	**Canada**	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia
Mathematics – *uncertainty*	**Canada** Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta, British Columbia	Prince Edward Island, Saskatchewan

* Difference is significant when the gender difference gap is significantly different from zero. Provinces within each cell are ordered from east to west.

Achievement of Canadian students by language of the school system

This section examines the mathematics performance of students in the French-language and English-language school systems for the five Canadian provinces in which these populations were separately sampled. The focus is on the performance of the minority group (students in French-language school systems in Nova Scotia, New Brunswick, Ontario, and Manitoba, and on students in the English-language school system in Quebec) relative to the majority group.

Results from PISA 2000 found that, for mathematics, only Ontario had significant differences between the two school systems, with results favouring the English-language school system. The PISA 2003 data confirm this finding (Table 1.5). Students in the English-language school system in Ontario outperformed students in the French-language school system by 26 points on the combined scale. No significant differences in combined mathematics performance were observed between the two school systems in Nova Scotia, New Brunswick, Quebec, and Manitoba.

With respect to mathematics performance in the four mathematics sub-domains, significant differences favouring the English-language school system were observed in Ontario across all mathematics sub-domains. Significant differences favouring the English-language school system were also observed in the *change and relationships* sub-domain in Nova Scotia and New Brunswick and in the *uncertainty* sub-domain in New Brunswick.

Table 1.5

Estimated average mathematics scores by province and language of the school system

	English-language school system		French-language school system	
	Estimated average score	95% confidence interval	Estimated average score	95% confidence interval
Mathematics – combined				
Nova Scotia	515	511-519	500	486-514
New Brunswick	514	511-517	505	499-511
Quebec	541	531-551	536	526-546
Ontario	**531**	524-538	**505**	496-514
Manitoba	528	522-534	522	511-[illegible]
Mathematics – *space and shape*				
Nova Scotia	498	493-503	485	[illegible]
New Brunswick	498	494-502	495	[illegible]
Quebec	526	516-536	528	[illegible]
Ontario	**513**	506-520	**491**	[illegible]
Manitoba	513	506-520	509	[illegible]
Mathematics – *change and relationships*				
Nova Scotia	**518**	513-523	**497**	482-512
New Brunswick	**516**	513-519	**505**	499-511
Quebec	543	532-554	536	526-546
Ontario	**537**	529-545	**505**	496-514
Manitoba	532	526-538	522	510-534
Mathematics – *quantity*				
Nova Scotia	511	506-516	495	479-511
New Brunswick	509	505-513	500	494-506
Quebec	535	524-546	530	520-540
Ontario	**527**	519-535	**500**	491-509
Manitoba	523	517-529	516	504-528
Mathematics – *uncertainty*				
Nova Scotia	528	524-532	514	500-528
New Brunswick	**527**	524-530	**514**	508-520
Quebec	547	537-557	541	531-551
Ontario	**541**	534-548	**512**	504-520
Manitoba	538	532-544	531	520-542

Note: Statistically significant differences are in bold.

Comparison of mathematics performance in PISA 2003 and PISA 2000

The availability of a third set of PISA assessment results in 2006 will allow for a reasonably reliable estimate of trends in performance over time. Nevertheless, it is still possible to compare PISA 2000 and 2003 results to assess whether performance among 15-year-olds has changed since 2000[10]. However differences should be interpreted with caution for several reasons. While the measurement approach used in PISA is consistent across cycles, small refinements were made. Consequently, small changes in results should be interpreted with care.

Given the differences between the PISA 2000 and 2003 assessment in mathematics in the content areas covered in each assessment, it is not appropriate to compare the overall mathematics scores of 2000 and 2003. However, it is possible to compare change in the two sub-domains – *space and shape*, and *change and relationships* – that were included in both assessments.

For Canada, as for the majority of the 25 OECD countries for which it is possible to make the comparison, there was no significant change in the performance on the *space and shape* sub-domain[11].

In contrast, for Canada as well as across OECD countries on average, performance on the *change and relationships* sub-domain improved[12] and represented the largest overall change observed across all areas of the PISA assessment including reading and science. For the OECD countries with comparable data, the average score increased from 488 points in 2000 to 499 points in 2003. For Canada the average score increased from 520 points to 537 points.

Across the provinces, there was also no significant change in the performance in *the space and shape* sub-domain (Table 1.6). Performance in the *change and relationships* sub-domain improved in Newfoundland and Labrador, New Brunswick, Ontario, Alberta, and British Columbia while performance was not significantly different in Prince Edward Island, Nova Scotia, Quebec, Manitoba, and Saskatchewan.

Table 1.6

Comparison of average performance in mathematics PISA 2003 and PISA 2000

	PISA 2000		PISA 2003	
	Estimated average score	95% confidence interval	Estimated average score	95% confidence interval
Mathematics – *space and shape*				
Newfoundland and Labrador	489	482-496	498	485-511
Prince Edward Island	500	492-508	480	467-493
Nova Scotia	498	491-505	498	485-510
New Brunswick	497	490-504	498	485-510
Quebec	536	531-541	528	514-543
Ontario	504	498-510	512	499-526
Manitoba	517	507-527	513	499-526
Saskatchewan	507	500-514	500	486-514
Alberta	523	516-530	534	520-549
British Columbia	519	513-525	523	510-535
Canada	515	512-518	518	505-530
Mathematics – *change and relationships*				
Newfoundland and Labrador	**497**	491-503	**521**	510-531
Prince Edward Island	506	499-513	502	492-512
Nova Scotia	505	500-510	517	507-528
New Brunswick	**497**	492-502	**513**	503-524
Quebec	529	524-534	538	524-551
Ontario	**513**	508-518	**536**	524-548
Manitoba	523	515-531	532	521-544
Saskatchewan	517	511-523	520	508-532
Alberta	**533**	527-539	**554**	542-567
British Columbia	**525**	519-531	**543**	532-554
Canada	**520**	517-523	**537**	526-547

Note: The 2003 confidence interval includes a linking error associated with the uncertainty that results from making comparisons with PISA 2000 (see endnote 10). Statistically significant differences are in bold.

Summary

In an increasingly technical world, mathematics is key to many areas of activity both inside and outside of school. Canada's performance in PISA 2003 suggests that, on the whole, Canadian 15-year-olds will have the skills and knowledge to participate in today's knowledge-based economy and will have a strong foundation upon which to continue with learning throughout life. However, while Canada's performance in PISA overall was good, the existence of disparities among provinces, and disparities among some students within some provinces warrants further analysis.

While the comparative approach taken in this chapter does not lend itself to developing explanations for these disparities, the PISA dataset along with other data available will allow an in-depth exploration of how resources, schools and classroom conditions, as well as individual and family circumstances, affect variation in achievement.

Factors that influence mathematics performance are complex and varied and these detailed relationships should be the focus of future research using the PISA data. However, two themes related to mathematics performance will be explored in Chapter 3 and 4 of this report.

Notes

6. The OECD average for the combined mathematics score was established with the data weighted so that each OECD country contributed equally. As the anchoring of the scale was done for the combination of the four sub-domain scales, the average mean and standard deviation for the sub-domain scales differ from 500 and 100 score points.
7. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.
8. It should be noted, however, that only two mathematics content areas were included in the 2000 assessment. The fact that gender differences were not observable does not mean that they do not exist in other countries but rather that the PISA 2000 design may not have been sensitive enough to detect them reliably.
9. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.
10. Please refer to Annex A8 of the OECD (2004) *Learning for Tomorrow's World – First results from PISA 2003* for an explanation of the methods used to establish the link between the PISA 2000 and 2003 assessment.
11. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.
12. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.

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Chapter 2

The performance of Canadian students in reading, science and problem solving in an international context

This chapter presents the overall results of the PISA 2003 assessments in the minor domains of reading, science and problem solving. Assessment in these minor domains was not as detailed as the mathematics assessment, which was the major focus of PISA 2003. Consequently, this chapter focuses on providing an update on overall performance in these three domains. First, the average performance of Canadian 15-year-old students is compared to the performance of 15-year-old students from countries that participated in PISA 2003. Second, students' performance in the ten Canadian provinces are presented and discussed. Third, this is followed by a comparison between the performance of boys and girls in Canada and the provinces. Fourth, the performance of students enrolled in English-language and French-language school systems are compared for the five provinces in which the two groups were separately sampled. Lastly, the results of PISA 2003 are compared with those of PISA 2000 for reading and science. A similar comparison is not possible for problem solving since this area was assessed for the first time in 2003.

Defining reading, science and problem solving

Both reading and science were minor domains in PISA 2003. On the other hand, reading was the major domain of PISA 2000 while science will be the major domain in PISA 2006. Additionally, problem solving, a new minor assessment domain in PISA 2003, was introduced to complement the assessment of the more academic domains. Reading, science and problem solving were defined as follows by international experts who agreed that the emphasis should be placed on functional knowledge and skills that allow active participation in society.

Reading literacy (hereafter referred to as reading):

> An individual's capacity to understand, use and reflect on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society;

Scientific literacy (hereafter referred to as science):

> An individual's capacity to use scientific knowledge, to identify questions, and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity;

Problem-solving skills (hereafter referred to as problem solving):

> An individual's capacity to use cognitive processes to confront and resolve real, cross-disciplinary situations where the solution path is not immediately obvious and where the literacy domains or curricular

areas that might be applicable are not within a single domain of mathematics, science, or reading.

For PISA, the scores for reading[13], science, and problem solving are expressed on a scale with an average or mean of 500 points and a standard deviation of 100. Approximately two-thirds of the students scored between 400 and 600 (i.e. within one standard deviation of the average) for the OECD countries.

Canadian students performed well in reading, science and problem solving

One way to summarize student performance, and to compare the relative standing of countries is by examining their average test scores. However, simply ranking countries based on their average scores can be misleading because there is a margin of error associated with each score. As discussed in Chapter 1, when interpreting average performances, only those differences between countries that are statistically significant should be taken into account. Table 2.1 shows the countries that performed significantly better than or the same as Canada in reading, science and problem solving. The averages of the students in all of the remaining countries were significantly below those of Canada. Overall, Canadian students performed well. Among the 41 countries that participated in PISA 2003, only Finland performed better than Canada in reading, and four countries performed better than Canada in science and problem solving.

Table 2.1

Countries performing better than, or the same as Canada

	Countries performing significantly better* than Canada	Countries performing the same* as Canada
Reading	Finland	Korea, Australia, Liechtenstein, New Zealand
Science	Finland, Japan, Hong Kong-China, Korea	Liechtenstein, Australia, Macao-China, Netherlands, Czech Republic, New Zealand, Switzerland, France
Problem Solving	Korea, Hong Kong-China, Finland, Japan	New Zealand, Macao-China, Australia, Liechtenstein, Belgium, Switzerland, Netherlands

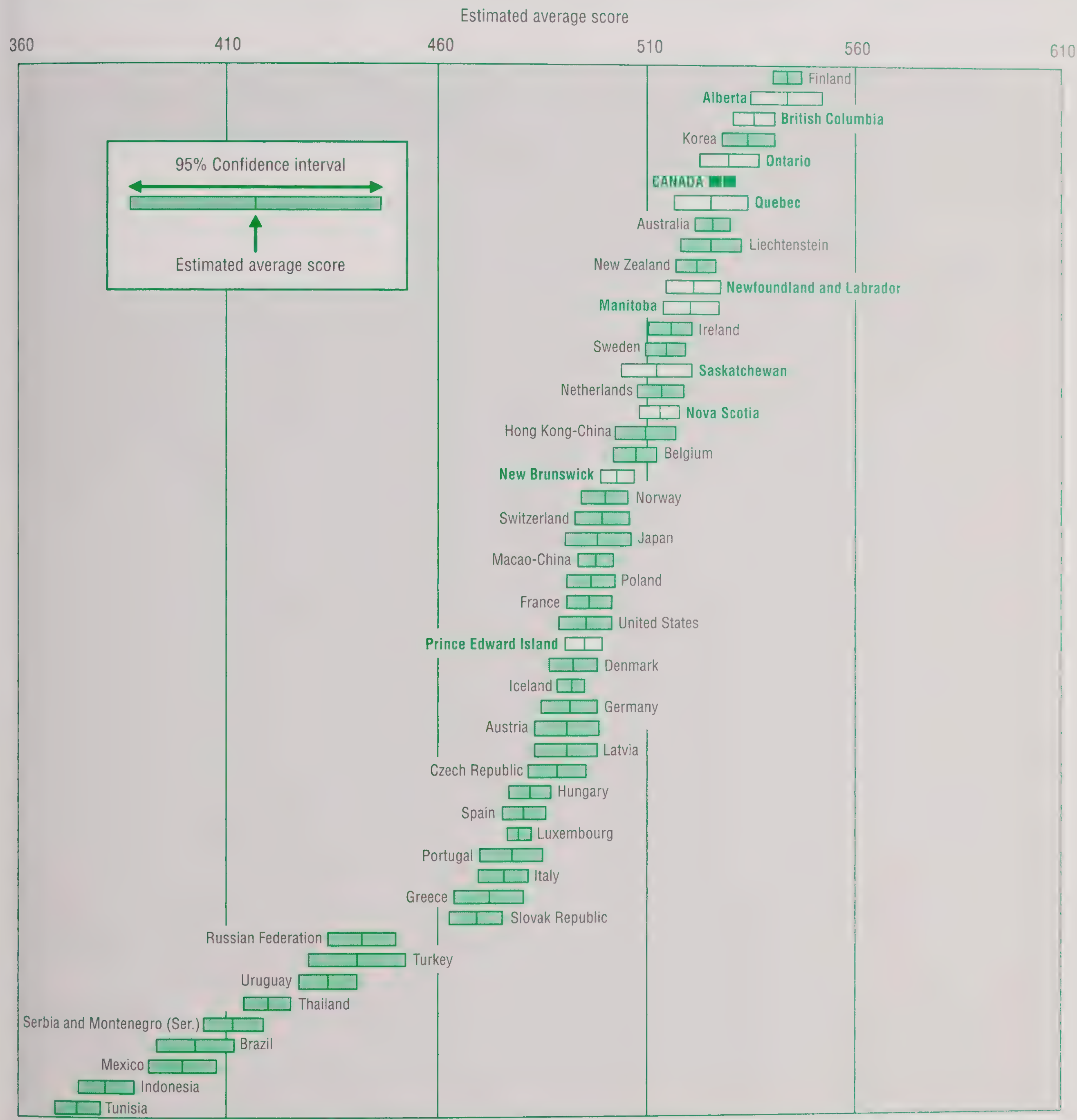
Differences in scores are statistically significant only when confidence intervals do not overlap. Countries performing about the same as Canada have a confidence interval that overlaps that of Canada.

Results of PISA 2003 in reading confirm the findings that were observed in 2000 when reading was the major emphasis (Figure 2.1). Canadian 15-year-olds continue to perform very well in reading: the overall achievement of Canadian students was significantly above the OECD average and only students in Finland outperformed Canadian students.

The performance of Canadian 15-year-olds in science and problem solving was also significantly above the OECD average (Figures 2.2 and 2.3). However relative to Canada's position in mathematics and reading Canadian students did not perform as strongly in these two domains. Four countries performed significantly better than Canada in both science and problem solving. Eight countries performed as well as Canada in science and seven countries performed as well as Canada in problem solving.

Figure 2.1

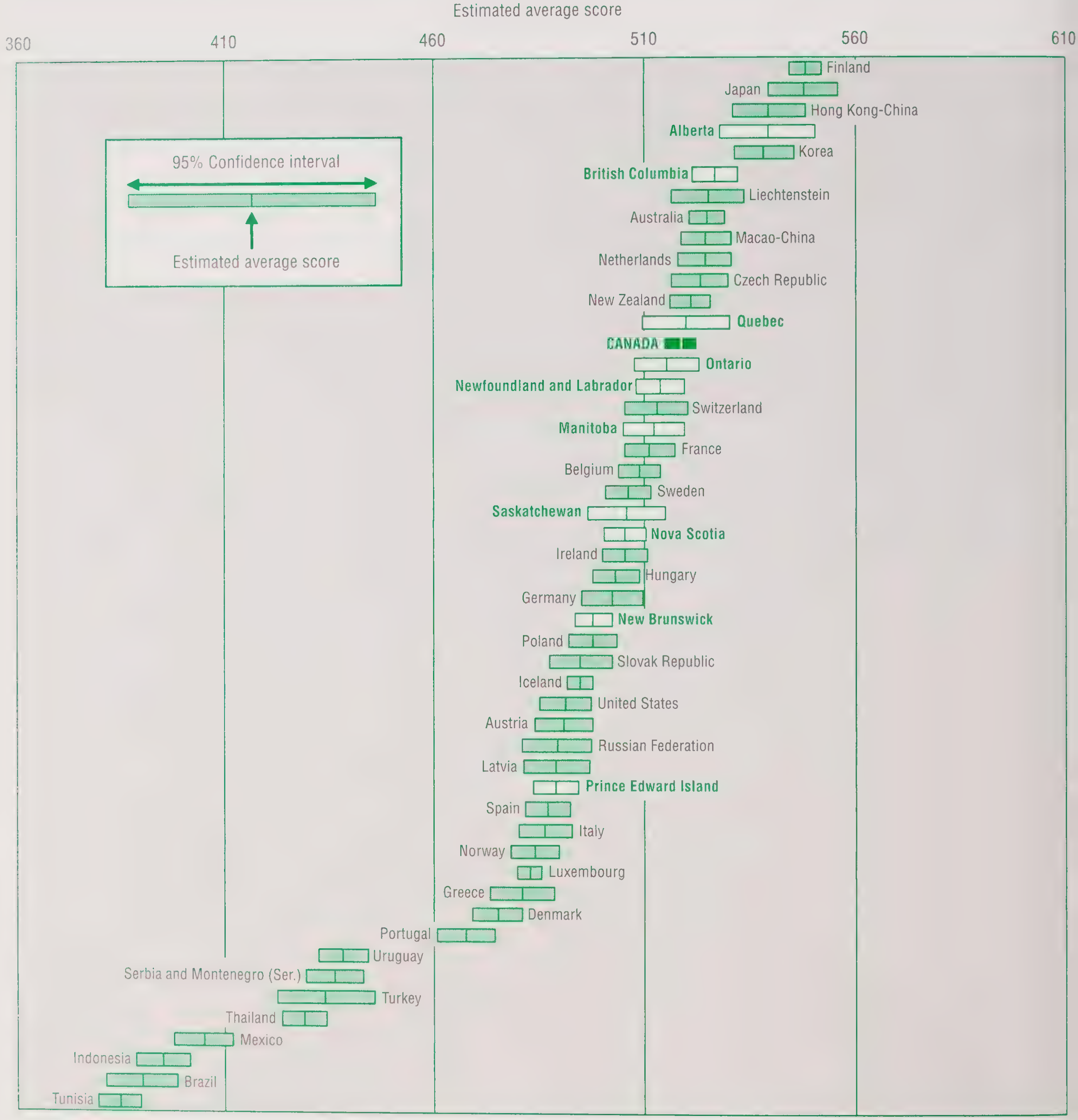
Estimated average scores and confidence intervals for provinces and countries: READING



Note: The reading results for 2003 are based on the reading literacy proficiency scale that was developed for PISA 2000 which had a mean of 500 for the 27 countries that participated in PISA 2000. However, because three additional OECD countries are included in the PISA 2003 reading test, the overall OECD mean for PISA 2003 is 494 with a standard error of 0.6.

Figure 2.2

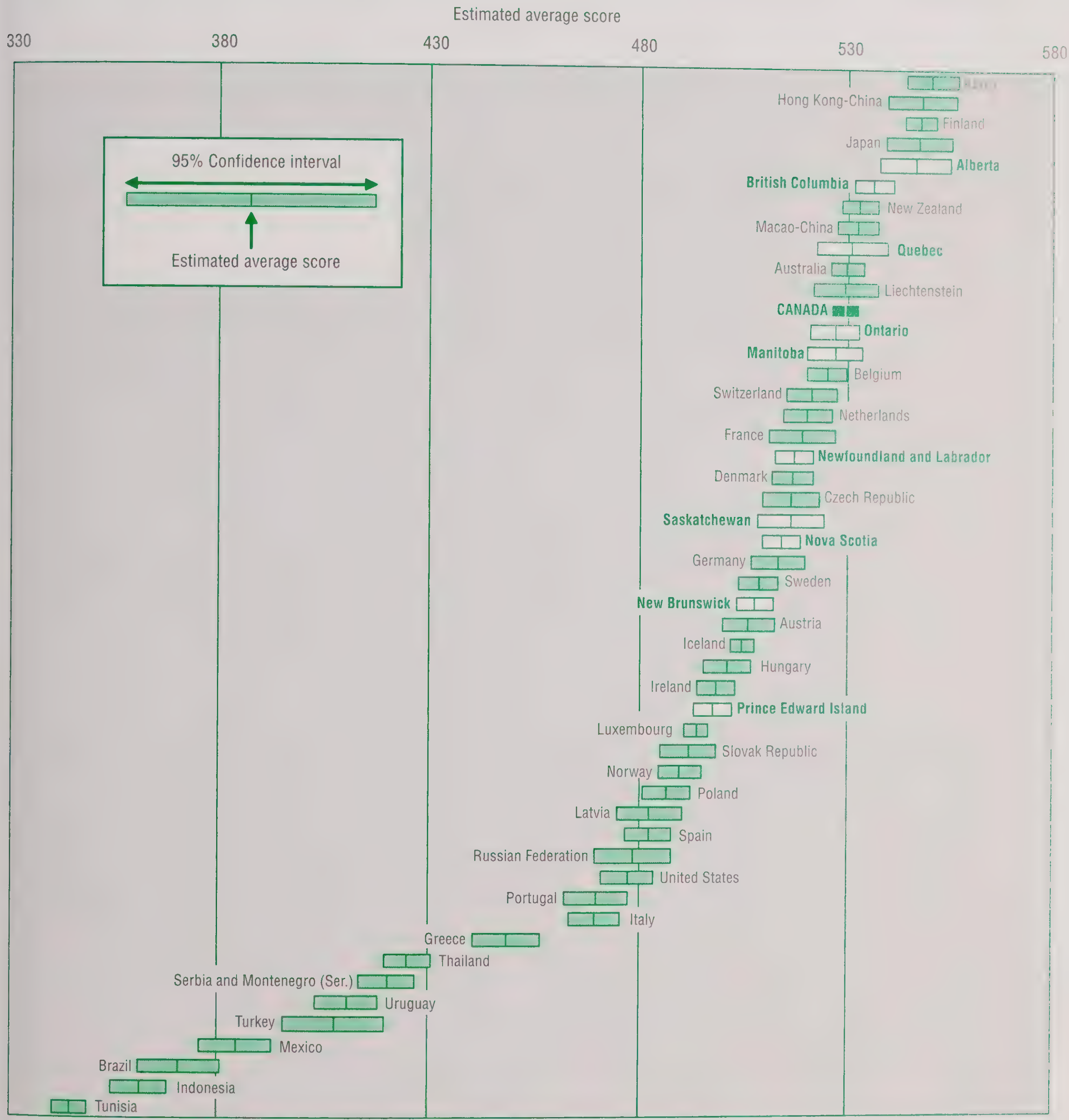
Estimated average scores and confidence intervals for provinces and countries: SCIENCE



Note: The OECD mean is 500 with a standard error of 0.6.

Figure 2.3

Estimated average scores and confidence intervals for provinces and countries: PROBLEM SOLVING



Note: The OECD mean is 500 with a standard error of 0.6.

Provincial results

Across the three minor domains of PISA 2003 the performance of students in all provinces was, with a few exceptions, above the OECD average. Students in New Brunswick, Nova Scotia and Saskatchewan performed at the OECD average in science while students in Prince Edward Island performed at the OECD average in reading and problem solving and below the OECD average in science.

As shown in Table 2.2, students in Alberta performed above the Canadian average in all the minor domains while students in Quebec, Ontario, Manitoba and British Columbia performed at the Canadian average in all the minor domains. Students in Newfoundland and Labrador performed at the Canadian average in reading and science, but below the average in problem solving. Students in Prince Edward Island, New Brunswick, Nova Scotia and Saskatchewan performed below the Canadian average in all minor domains.

Table 2.2

Provincial results in reading, science and problem solving in relation to the Canadian average

	Provinces performing significantly better* than the Canadian average	Provinces performing the same* as the Canadian average	Provinces performing significantly lower* than the Canadian average
Reading	Alberta	Newfoundland and Labrador, Quebec, Ontario, Manitoba, British Columbia	Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan
Science	Alberta	Newfoundland and Labrador, Quebec, Ontario, Manitoba, British Columbia	Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan
Problem Solving	Alberta	Quebec, Ontario, Manitoba, British Columbia	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan

Differences in scores are statistically significant only when confidence intervals do not overlap. Provinces performing about the same as Canada as a whole have a confidence interval that overlaps that of Canada. Provinces within each cell are ordered east to west.

How does the performance of boys and girls compare?

Table 2.3 summarizes the gender differences for PISA 2003 in reading, science, and problem solving. As was the case in PISA 2000, in PISA 2003 girls performed significantly better than boys on the reading test in all but one country[14] and in all provinces (Appendix tables B2.4-B2.6). The gap between girls and boys in reading was much larger than the gap between boys and girls in mathematics. In Canada, while boys outperformed girls by eleven points in mathematics, girls outperformed boys by 32 points in reading.

In PISA 2000, no significant gender differences were observed between boys and girls in any country or any province on the science test. In PISA 2003, in Canada as well as eleven other countries, boys performed significantly better than girls on the science test[15]. However, as with mathematics, the gap was small at six points in Canada and six points at the OECD average. At the provincial level, boys outperformed girls in Manitoba, Nova Scotia, and Ontario[16].

For problem solving, girls outperformed boys in six countries. No significant gender differences were observed in Canada. At the provincial level, girls outperformed boys in Prince Edward Island and Saskatchewan[17].

Table 2.3

Summary of gender differences for Canada and the provinces

	Girls performed significantly higher* than boys	Boys performed significantly higher* than girls	No significant differences between boys and girls
Reading	Canada, All provinces		
Science		Canada, Nova Scotia, Ontario, Manitoba	Newfoundland and Labrador, Prince Edward Island, New Brunswick, Quebec, Saskatchewan, Alberta, British Columbia
Problem Solving	Prince Edward Island, Saskatchewan		Canada, Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta, British Columbia

* Difference is significant when the gender difference gap is significantly different from zero. Provinces within each cell are ordered fr[illegible] east to west.

Achievement of Canadian students by language of the school system

This section examines the performance of students in the English-language and French-language school systems for the five Canadian provinces that sampled these population groups separately. The focus is on the performance of the minority group (students in French-language school systems in Nova Scotia, New Brunswick, Ontario and Manitoba and students in the English-language school system in Quebec) relative to the majority.

A comparison of PISA results within each of these five provinces is given in Table 2.4. As was the case in PISA 2000, students enrolled in the French-language school systems in Nova Scotia, New Brunswick, Ontario and Manitoba performed significantly lower in both reading and science than did students in the English-language system in the same provinces. In Quebec, student performance in reading, and science did not differ between the English-language and French-language school systems.

For problem solving, there were significant differences favouring the English-language system in Nova Scotia, New Brunswick, and Ontario, while no significant differences were observed in Quebec and Manitoba.

Table 2.4

Estimated average reading, science and problem solving scores by province and language of the school system

	English-language school system		French-language school system	
	Estimated average score	95% confidence interval	Estimated average score	95% confidence interval
Reading				
Nova Scotia	**514**	509-519	**467**	453-481
New Brunswick	**510**	506-514	**485**	479-491
Quebec	530	520-540	524	515-533
Ontario	**531**	524-538	**495**	485-505
Manitoba	**521**	514-528	**494**	482-506
Science				
Nova Scotia	**506**	501-511	**465**	450-480
New Brunswick	**505**	501-509	**480**	473-487
Quebec	523	511-535	518	507-529
Ontario	**517**	509-525	**479**	469-489
Manitoba	**513**	506-520	**490**	477-503
Problem Solving				
Nova Scotia	**514**	509-519	**493**	479-507
New Brunswick	**511**	507-515	**497**	491-503
Quebec	538	528-548	529	520-538
Ontario	**528**	521-535	**504**	495-513
Manitoba	527	521-533	516	504-528

Note: Statistically significant differences are in bold. Differences in scores are statistically significant only when confidence intervals do not overlap

Comparison of reading and science performance in PISA 2003 and 2000

It is possible to compare PISA 2000 and 2003 results for reading and science to assess whether performance among 15-year-olds has changed since 2000[18]. However, as mentioned in Chapter 1, small differences should be interpreted with caution.

In Canada, as well as for sixteen other countries, the mean reading performance of 15-year-olds did not change measurably from 2000 to 2003. Reading performance increased in five countries and decreased for ten countries for which there is comparable data[19]. While reading performance did not change for Canada overall and for eight provinces, reading performance among 15-year-olds decreased in Prince Edward Island and Saskatchewan (Table 2.5).

In Canada, as well as in four other countries (Austria, Norway, Mexico, Korea), students had lower science performance in PISA 2003 compared to PISA 2000. Science performance of 15-year-olds increased significantly in thirteen countries while performance remained unchanged in the remaining fourteen countries for which comparative data are available[20]. Lower performance in science was observed in Prince Edward Island, Quebec, and Saskatchewan. No significant changes in science performance were observed in the other provinces (Table 2.5).

Table 2.5

Comparison of estimated average performance in reading and science PISA 2003 and PISA 2000

	PISA 2000		PISA 2003	
	Estimated average score	95% confidence interval	Estimated average score	95% confidence interval
Reading				
Newfoundland and Labrador	517	512-522	521	511-531
Prince Edward Island	**517**	512-522	**495**	486-503
Nova Scotia	521	516-526	513	504-521
New Brunswick	501	497-505	503	494-511
Quebec	536	530-542	525	514-536
Ontario	533	527-539	530	520-540
Manitoba	529	522-536	520	511-530
Saskatchewan	**529**	524-534	**512**	501-523
Alberta	550	544-556	543	532-55[illegible]
British Columbia	538	532-544	535	526-54[illegible]
Canada	534	531-537	528	520-536
Science				
Newfoundland and Labrador	516	509-523	514	506-522
Prince Edward Island	**508**	503-513	**489**	481-497
Nova Scotia	516	510-522	505	498-5[illegible]
New Brunswick	497	492-502	498	491-505
Quebec	**541**	534-548	**520**	508-532
Ontario	522	515-529	515	506-525
Manitoba	527	520-534	512	503-522
Saskatchewan	**522**	516-528	**506**	[illegible]
Alberta	546	539-553	539	[illegible]
British Columbia	533	527-539	527	[illegible]
Canada	**529**	526-532	**519**	512-526

Note: The 2003 confidence interval includes a linking error associated with the uncertainty that results from making comparisons with PISA 2000 (see endnote 18). Statistically significant differences are in bold. Due to rounding error, non-overlapping confidenc[e] intervals in Science for Saskatchewan and Canada share an upper or lower limit.

Summary

Because reading, science and problem solving were considered to be minor domains in PISA 2003, a smaller proportion of students were assessed in those domains compared to the mathematics assessment, which was the major focus of the 2003 assessment. Additionally, a smaller number of items were included in each of these assessments than were included in the mathematics assessment. Consequently, this chapter focuses on providing an update on overall performance in each of these domains.

PISA 2003 results confirmed the PISA 2000 findings with respect to the performance of Canadian students in reading. Canadian 15-year-olds continue to perform very well in reading, being outperformed by students in only Finland among a total of 41 countries. Canada also performed well in science and problem solving, with four countries outperforming Canadian students in each of these two domains.

Although performing well overall in all skill domains, the existence of disparities among provinces across the domains warrants further analysis. Canada's relative performance in science also warrants further investigation. Compared to Canada's relative position in mathematics and reading, Canadian students fare less well in science. Additionally, Canada was only one of five countries that had lower science performance in 2003 than in 2000. The next PISA assessment in 2006, focusing on science, will provide a more definitive profile of Canada's performance in this domain.

Notes

13. The reading results for 2003 are based on the reading scale that was developed for PISA 2000 which had a mean average of 500 and a standard deviation of 100 for the 27 OECD countries that participated in PISA 2000. However, because three additional OECD countries are included in the PISA 2003 reading test, the overall OECD average for reading for PISA 2003 is 494.
14. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.
15. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.
16. The fact that gender differences were not observable does not mean that they do not exist in other countries but rather that the PISA 2000 design was not sensitive enough to detect them reliably.
17. See footnote above.
18. Please refer to Annex A8 of the OECD (2004) *Learning for Tomorrow's World – First results from PISA 2003* for an explanation of the methods used to establish the link between the PISA 2000 and 2003 assessment.
19. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.
20. OECD (2004), *Learning for Tomorrow's World – First results from PISA 2003*, Paris.

Chapter 3

The relationship between student engagement, student learning, and mathematics performance

The level of student engagement in mathematics is important for acquiring skills and knowledge in mathematics. Students who are engaged in the learning process will tend to learn more and be more receptive to the pursuit of knowledge. Furthermore, student engagement in mathematics has an impact upon course selection, educational pathways, and career choices. Likewise, the learning strategies that students employ may also have an impact on both their ability to succeed in school and in their ability to pursue lifelong learning. For example, students who leave school with the ability to set their own learning objectives are well equipped to continue the learning process throughout their lives. Consequently, students' engagement with learning and the learning strategies they employ constitute an important outcome of education.

In this chapter, the relationships between student engagement, learning strategies, preferences for learning, and mathematics achievement are explored. To begin, student engagement as measured by motivation to learn, confidence in learning, and anxiety associated with learning mathematics is described for both Canadian students in comparison with OECD students as a whole and for students across the provinces in relationship to the Canadian average. Next, the impact of these engagement measures on mathematics performance is described. This is followed by an examination of gender differences in mathematics engagement.

The second part of this chapter examines the various learning strategies used and the type of learning situations preferred by Canadian students in relation t other OECD students and students across the provi compared to the Canadian average. Next, the relationshi between learning strategies and preferences for learnin situations and mathematics achievement is explor Lastly, a comparison is made between high and l achievers in mathematics vis-à-vis their learnir strategies and preferences for learning situations.

Engagement in mathematics

PISA collected information on a variety of dimensions of student engagement to explore the extent to which students believe that they can succeed in mathematics, why they want to learn mathematics, and what they feel about learning mathematics. Student engagement in mathematics refers to students' motivation to learn mathematics, their confidence in their ability to succeed in mathematics, and their emotional feelings about mathematics. Based on student responses to a series of questions, PISA constructed five indices related to these variables:

Motivation

Interest and enjoyment in mathematics measures an individual's interest and enjoyment in mathematics.

Instrumental motivation to learn mathematics reflects an individual's belief that mathematics will be useful for future employment or education. Students were asked to what extent they are encouraged to learn by external rewards such as good job prospects. Instrumental motivation is also referred to as *belief in the usefulness of mathematics.*

Confidence

Mathematics self-efficacy measures students' feelings of confidence about being able to solve specific mathematical problems. Mathematics self-efficacy is also referred to as *mathematics confidence.*

Mathematics self-concept measures an individual's perception of their ability to learn mathematics. Mathematics self-concept is also referred to as *perceived ability in mathematics.*

Anxiety

Mathematics anxiety is concerned with feelings of helplessness and emotional stress when dealing with mathematics.

Each index was constructed so that the average score across the OECD countries is 0 and two-thirds of the scores are between -1.0 and 1.0 (i.e. a standard deviation of 1).

Comparing Canada with the OECD and provinces with Canada

In this chapter, scores for Canada are compared with the OECD average. The OECD average can be used to see how a country compares on a given indicator with a typical OECD country. The OECD average does not take into account the absolute size of the student population in each country, i.e., each country contributes equally to the average.

Significant differences are calculated by constructing a 95% confidence interval around the average (for more information on confidence intervals, please refer to chapter 1 – A note on statistical comparisons). In comparing Canada with the OECD average for a given indicator, scores not significantly different from zero indicate *average* levels of the attribute measured by a given index. Scores significantly above 0 represent *above-average* levels and scores significantly below 0 represent *below-average* levels of the attribute measured by a given characteristic. For example, a positive value for Canada on the index of instrumental motivation to learn mathematics, with a corresponding 95% confidence interval whose lower bound is above zero (i.e. average=0.23, 95% confidence interval=0.20-0.26), means that the average score for Canadian 15-year-olds on this index is *above-average* compared to the OECD average of zero.

When comparisons are made between Canada and the provinces, provincial averages are considered different from the Canadian average if their confidence intervals do not overlap with the confidence interval for Canada. All confidence intervals for Canada and the provinces are presented in the appendix tables.

Canadian students believe strongly in the usefulness of mathematics to their future education and employment

Motivation to learn is a driving force behind learning and Canadian 15-year-old students appear to be well motivated to learn mathematics. While Canadian students were just as interested in mathematics and enjoyed it as much as students in OECD countries as a whole, they believed more strongly in its usefulness to their future employment and education.

Motivation to learn can be activated through an interest in and enjoyment of mathematics. Compared to the OECD average, Canadian 15-year-old students reported similar levels of interest in and enjoyment of mathematics. While there was variation in the provincial averages, the average scores of all provinces were not different from the Canadian average with the exception of British Columbia where students reported levels of interest and enjoyment in mathematics that were below the Canadian average (Table 3.1).

Motivation to learn mathematics may also be driven by the belief that mathematics will be useful to one's future job or further studies. Compared to the OECD average, Canadian 15-year-olds held an above-average belief that mathematics would be useful for their future employment and education (Appendix Table B3.1). The averages for all provinces were also above the OECD average. However, there were differences across the provinces. Students in Nova Scotia and Quebec possessed the strongest belief, above the Canadian average. The average scores for students in Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, and Saskatchewan were not significantly different from the Canadian average. Lastly, the average scores for students in New Brunswick, Ontario, and British Columbia were below the Canadian average, suggesting that they were not as positive about the usefulness of mathematics to their future jobs and education.

Canadian students were more confident that they could succeed in mathematics than students in all OECD countries combined

The views that students form about their own competence in mathematics may impact on the goals they set as well as on their achievement. Compared to the OECD average, Canadian students were more confident that they could succeed in mathematics.

Canadian students reported above-average levels of mathematics confidence and above-average levels in their perceived ability in mathematics. There were, however, differences among the provinces (Appendix Table B3.1). Compared to the Canadian average, students in Quebec and Alberta reported higher levels of mathematics confidence; students in Newfoundland and Labrador and British Columbia did not differ significantly from the Canadian average while students in the remaining provinces reported lower levels of mathematics confidence compared to the Canadian average (Table 3.1). Compared to the Canadian average, students in Alberta and Quebec reported above-average levels in their perceived ability in mathematics while students in Ontario, Manitoba, and British Columbia reported below-average levels (Table 3.1).

Table 3.1

Provincial scores on indices of student engagement in mathematics relative to the Canadian average

	Provinces performing significantly higher* than the Canadian average	Provinces performing the same* as the Canadian average	Provinces performing significantly lower* than the Canadian average
Interest and enjoyment in mathematics		Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta	British Columbia
Belief in the usefulness of mathematics	Nova Scotia, Quebec	Newfoundland and Labrador, Prince Edward Island, Manitoba, Saskatchewan, Alberta	New Brunswick, Ontario, British Columbia
Mathematics confidence	Quebec, Alberta	Newfoundland and Labrador, British Columbia	Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskat[illegible]
Perceived ability in mathematics	Quebec, Alberta	Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Saskatchewan	Manitoba, Ontario, British Columbia
Mathematics anxiety	Ontario	New Brunswick, Quebec, Manitoba, Saskatchewan, Alberta, British Columbia	Newfoundland and Labrador, Prince Edward Island, Nova Scotia

* Differences in scores are statistically significant only when confidence intervals do not overlap. Provinces performing about the same as Canada as a whole have a confidence interval that overlaps that of Canada. Provinces within each cell are ordered from east to west.

Canadian students are slightly less anxious in dealing with mathematics than students in all OECD countries combined

Emotional stress in learning mathematics may lead to avoidance of mathematics and impede learning. Compared to the OECD average, fifteen-year-old students in Canada reported slightly lower levels of anxiety in dealing with mathematics (see Appendix Table B3.1). Students in Newfoundland and Labrador, Prince Edward Island, and Nova Scotia reported levels of mathematics anxiety below the Canadian average. Students in Ontario reported levels of anxiety above the Canadian average. The level of anxiety reported by students in other provinces was not significantly different from the Canadian average (Table 3.1).

Canadian students with high levels of engagement in mathematics have higher mathematics performance

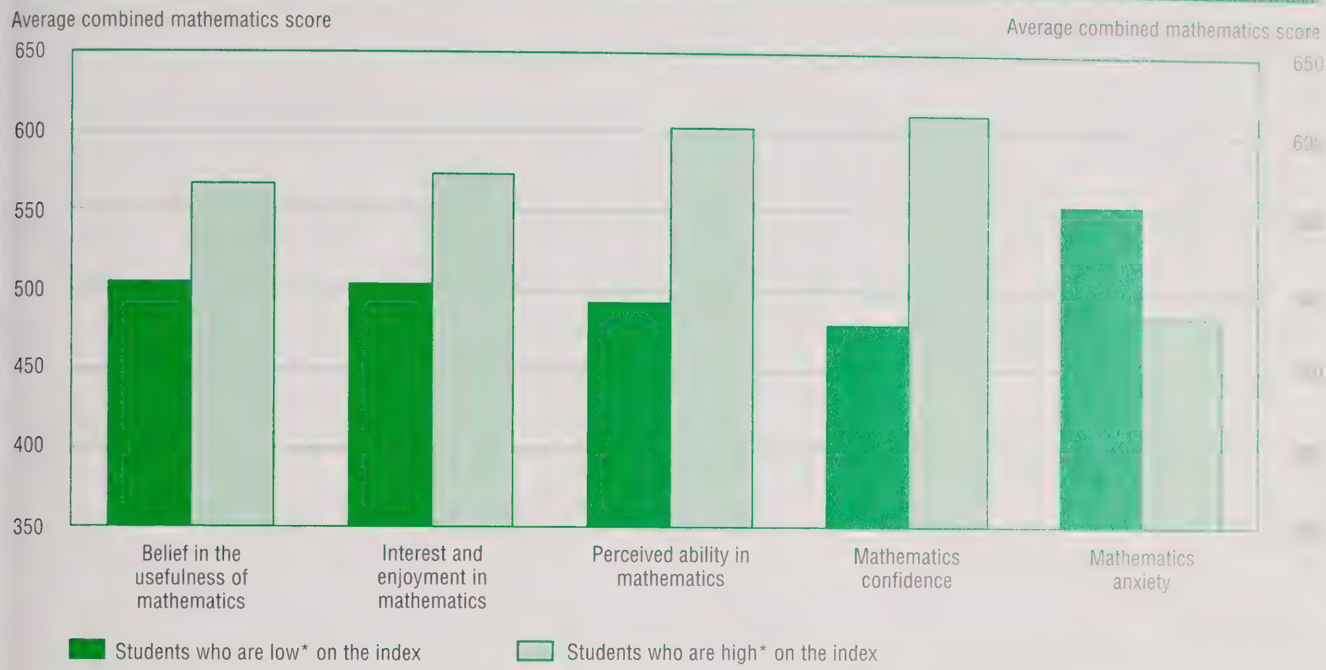
There is a complex and often circular relationship between student engagement in mathematics and actual performance. For example, the more students succeed in mathematics the more likely they are to believe they can succeed. The more students believe they can succeed the more engaged they will become with learning mathematics. The relationship between mathematics achievement and the various measures of engagement in mathematics is strong. Canadian students reporting high levels (one standard deviation above the average) of mathematics confidence scored 133 points higher on the combined mathematics scale than did students reporting low levels (one standard deviation below the average, Figure 3.1).This represents a difference of two mathematics proficiency levels in mathematics.

The average combined mathematics score of students with high levels of perceived ability in mathematics was 111 points higher than the average combined mathematics score of students with low levels of perceived ability in mathematics. Similarly, the difference in the average combined mathematics score between students with high and low interest and enjoyment in mathematics and students with high and low levels of belief in the usefulness of mathematics were 70 and 62 points respectively (Figure 3.1). Mathematics anxiety had a strong negative relationship with mathematics performance: the average performance of students with high levels of mathematics anxiety was 71 points lower than the average performance of students with low levels of mathematics anxiety.

The patterns of the effects of student motivation (belief in the usefulness of mathematics and interest and enjoyment in mathematics), mathematics confidence, and mathematics anxiety on mathematics performance across the provinces mirror those for Canada. In all provinces, students with high levels of student motivation and mathematics confidence and low levels of mathematics anxiety outperformed students with low levels of student motivation and mathematics confidence and high levels of mathematics anxiety (Appendix Table B3.2).

Figure 3.1

Combined mathematics score for students with high mathematics engagement compared to students with low mathematics engagement



* Students low on a given index are defined as those falling one standard deviation below the average, students high on a given index a defined as those falling one standard deviation above the average.

Canadian girls and boys are not equally engaged in mathematics

Students' mathematics confidence, their perceived abilities in mathematics, and their beliefs in the value of mathematics for future work and education may have an important impact on their course selections, educational pathways and career choices. Differences exist between the mathematics engagement of Canadian boys and girls (Table 3.2). For example, after controlling for mathematics performance, girls reported lower levels of confidence in their ability to solve specific mathematical problems, lower levels of their perceived ability to learn mathematics and higher levels of anxiety in dealing with mathematics. Girls were also less likely to believe that mathematics will be useful for their future employment and education and were more likely to report lower levels of interest and enjoyment in mathematics.

The same pattern was observed across provinces with the following exceptions: in Newfoundland and Labrador boys and girls with the same level of ability did not differ in their level of interest and enjoyment in mathematics; girls in Prince Edward Island, Nova Scotia, Manitoba, and Saskatchewan had higher levels of interest and enjoyment in mathematics than males; and in Newfoundland and Labrador, both boys and girls with the same level of ability reported similar levels of belief in the usefulness of mathematics (Table 3.2, Appendix Table B3.3).

Table 3.2

Summary of gender difference in engagement in mathematics controlling for mathematics performance, Canada and the provinces

	Interest and enjoyment in mathematics	Belief in usefulness of mathematics	Perceived ability in mathematics	Mathematics confidence	Mathematics Anxiety
Canada	♂	♂	♂	♂	♀
Newfoundland and Labrador	○	○	♂	♂	♀
Prince Edward Island	♀	♂	♂	♂	♀
Nova Scotia	♀	♂	♂	♂	♀
New Brunswick	♂	♂	♂	♂	♀
Quebec	♂	♂	♂	♂	♀
Ontario	♂	♂	♂	♂	♀
Manitoba	♀	♂	♂	♂	♀
Saskatchewan	♀	♂	♂	♂	♀
Alberta	♂	♂	♂	♂	♀
British Columbia	♂	♂	♂	♂	♀

Note: ♂ = boys scored significantly higher on the index
♀ = girls scored significantly higher on the index
○ = no significant difference

Mathematics learning strategies and preferences for learning

Students develop and employ different cognitive strategies to learn mathematics. Additionally, some students learn better in a competitive learning environment while others learn better in a cooperative environment. Through a series of questions on the PISA student questionnaire, PISA measured the following learning strategies in mathematics and preferences for learning situations.

Learning strategies in mathematics

Memorization/rehearsal is a learning strategy that involves the use of memorization and rehearsing techniques and includes learning key themes and doing repeated learning of materials.

Elaboration is a learning strategy that involves elaborating mathematics concepts beyond the topic at hand such as making connections to related areas and thinking about alternative solutions, etc.

Control is a learning strategy that involves planning, regulating, and monitoring of learning in mathematics.

Preferences for learning situations

Preferences for cooperative learning situations reflect the preference for cooperative learning such as learning in groups.

Preferences for competitive learning situations reflect the preference on striving to be better than others.

Canadian students are more likely to use memorization, elaboration, and control strategies

Compared to the OECD average, Canadian students reported higher levels of using memorization and rehearsing techniques (learning answers and problems off by heart, repeating learning materials, and remembering every step in a mathematics procedure) for learning mathematics (Appendix Table B3.4). There were, however, differences among the provinces (Table 3.3). Compared to the Canadian average, students in Newfoundland and Labrador, and Alberta reported higher levels of memorization and rehearsal strategies, students in Prince Edward Island reported lower levels while students in the other provinces did not differ from the Canadian average (Appendix Table B3.4). However, this does not mean that memorization alone defines or characterizes Canadian and provincial approaches to mathematics.

Compared to the OECD average, Canadian students also reported slightly higher levels of elaborating mathematics concepts beyond the topic at hand such as making connections to related areas and thinking about alternative solutions. At the provincial level, only students in British Columbia differed from the Canadian average by reporting lower levels of elaboration strategies (Appendix Table B3.4).

PISA also explored the extent to which students take control over their learning of mathematics by involving themselves in the planning, regulating and monitoring of their learning in mathematics. However, it should be noted that there might be notable differences in how students from different countries perceive control strategies. For example, the degree to which students report that they are involved in their learning may depend on differences in the culturally-driven expectations of the learning process among different countries.

Compared to the OECD average, Canadian students were more likely to make use of these types of control strategies. There was a great deal of provincial variation in the level of control strategies reported by students (Table 3.3). Compared to the Canadian average, students in Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia reported below-average use of control strategies. Students in Newfoundland and Labrador and Quebec reported levels above the Canadian average (Appendix Table B3.4).

Canadian students are more likely to prefer both cooperative and competitive learning situations

Learning behaviour can also be influenced by stud[illegible] preferences for different kinds of learning situ[illegible] Compared to the OECD average, Canadian [illegible] a whole were more likely to express preference[illegible] cooperative learning such as learning [illegible] competitive learning such as striving to be bet[illegible] others. It should be noted that preferences for [illegible] and competitive learning are not mutuall[illegible] each other. Provincial averages did not di[illegible] Canadian average with the following exceptio[illegible] in Newfoundland and Labrador and [illegible] reported higher levels of preferences for co[illegible] learning situations; students in Alberta repor[illegible] levels of preferences for competitive learnin[illegible] students in Quebec reported lower levels of pre[illegible] for cooperative learning; and students in Prince [illegible] Island and Manitoba reported lower levels of [illegible] for competitive learning situations [illegible] Table B3.4).

Table 3.3

Provincial average scores on indices of learning strategies and preferences for learning relative to the Canadian average

	Provinces performing significantly higher* than the Canadian average	Provinces performing the same* as the Canadian average	Provinces performing significantly lower* than the Canadian average
Memorization/rehearsal	Newfoundland and Labrador, Alberta	Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, British Columbia	Prince Edward Island
Elaboration strategies		Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta	British Columbia
Control strategies	Newfoundland and Labrador, Quebec		Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia
Preferences for cooperative learning	Newfoundland and Labrador, New Brunswick	Prince Edward Island, Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia	Quebec
Preferences for competitive learning	Alberta	Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, Ontario, Saskatchewan, British Columbia	Prince Edward Island, Manitoba

* Differences in scores are statistically significant only when confidence intervals do not overlap. Provinces performing about the same as Canada as a whole have a confidence interval that overlaps that of Canada. Provinces within each cell are ordered from east to west.

Student learning strategies and preferred learning situations are related to mathematics performance

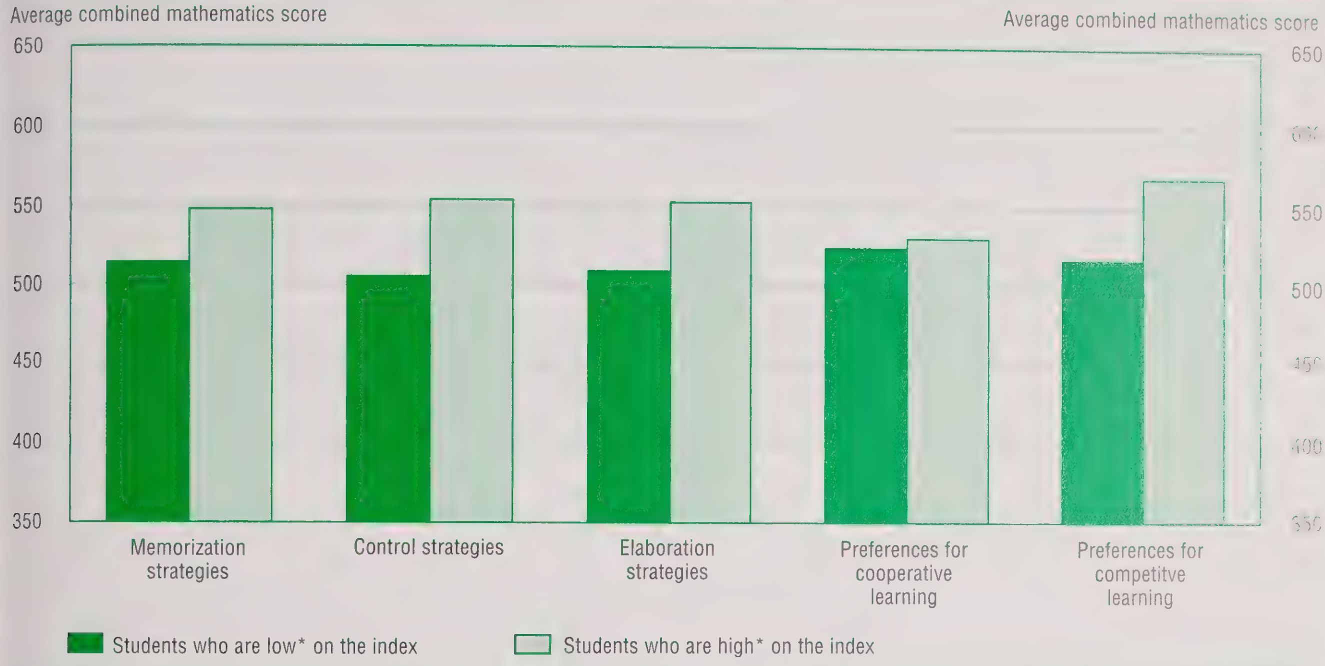
How do learning strategies relate to mathematics performance? Do various learning strategies directly impact performance or do students with different abilities have preferences for different learning strategies? It is difficult to determine whether various learning strategies directly impact performance or whether students with different abilities prefer different learning strategies or are in learning situations where different strategies are encouraged. For example, while it may be that students perform well because of the strategies they use for learning, it may also be the case that teachers tailor learning for individual students by encouraging high-performing students and low-performing students to use different learning strategies.

Overall, learning strategies were related to mathematics performance but the difference was not as pronounced as those observed for student engagement (Figure 3.2). Students who exhibited high levels of control strategies (one standard deviation above the average) scored 49 points higher than did students who exhibited low levels (one standard deviation below the average). The use of memorization and rehearsal strategies, as well as elaboration strategies, was also positively related to mathematics achievement. For each of these indices, students who exhibited high levels scored 34 and 43 points higher respectively than students who exhibited low levels.

While preferences for competitive learning situations were positively related to mathematics achievement, preferences for cooperative learning were not significantly related to achievement. Students with high levels of preference for competitive learning situations scored 52 points higher than did students with low levels of preference.

Figure 3.2

Combined mathematics score for students with high levels of various learning strategies and preferences for learning compared to students with low levels



* Students low on a given index are defined as those falling one standard deviation below the mean. Students high on a given index are defined as those falling one standard deviation above the mean.

High performers exhibit different learning strategies and preferences for learning situations than low achievers.

Table 3.4 shows the average score on the various indices of learning strategies and preferences for learning situations for high and low performers on the combined mathematics scale[21]. This table shows that high and low performers in mathematics prefer a different set of learning strategies. Overall, high performers tended to report higher levels of elaboration and control strategies than low performers. High performers also reported higher preferences for competitive learning environments whereas low performers reported higher preferences for cooperative learning. The same patterns were observed in all provinces with the exception of Quebec. In Quebec, high performers reported lower levels of both memorization strategies and elaboration strategies than low performers (Appendix Table B3.5).

Table 3.4

Average score for learning strategies and preferences for learning: low versus high performers on the combined mathematics scale, Canada

	Low performers on the combined mathematics scale		High performers on the combined mathematics scale	
	Index average	Standard error	Index average	Standard error
Memorization/rehearsal strategies	0.00	(0.04)	0.24	(0.02)
Control strategies	-0.25	(0.04)	0.24	(0.03)
Elaboration strategies	0.09	(0.03)	0.23	(0.02)
Preferences for cooperative learning	0.19	(0.04)	-0.02	(0.02)
Preferences for competitive learning	0.09	(0.03)	0.44	(0.03)

Note: Low performers are defined as those who score below 420 points on the combined mathematics scale which corresponds to a proficiency level of one or less. High performers are defined as those who score above 606 points on the combined mathematics scale, which corresponds to a proficiency level of five or higher.

Summary

The results from this chapter show that student engagement in mathematics is related to mathematics achievement. Both provincially and Canada-wide, students with high levels of mathematics confidence performed the equivalent of two proficiency levels higher (133 points) on the combined mathematics scale than did students with low levels. Students with high levels of mathematics anxiety performed the equivalent of one proficiency level lower (71 points) in mathematics than did students with low levels. Motivation to learn mathematics as measured by interest and enjoyment in mathematics and belief in the usefulness of mathematics was also positively related to achievement. It is difficult to disentangle the associations observed between mathematics engagement and performance. For example, are high motivation and confidence and reduced anxiety the causes of strong performance or by-products of doing well in mathematics? Nevertheless, the strong link between student engagement in mathematics and mathematics performance suggest that high motivation and self-confidence and low mathematics anxiety are important outcomes in themselves.

Of particular interest is the finding that even when controlling for ability, girls consistently show much lower interest and enjoyment in mathematics, lower self-related beliefs and higher levels of mathematics anxiety than boys. This gender inequity may contribute to gender differences in the educational and occupational career choices.

Learning strategies and preferences for learning were not as strongly related to mathematics performance as was student engagement. However, the results revealed that high and low performers in mathematics had different learning strategies and preferences for learning. While high performers in mathematics were more likely to prefer memorization/rehearsal, elaboration and control strategies and competitive learning environments, low performers were more likely to prefer cooperative learning environments.

Notes

21 Low performers are defined as those who score below 420 points on the combined mathematics scale which corresponds to a proficiency level of one or less. High performers are defined as those who score above 606 points on the combined mathematics scale which corresponds to a proficiency level of five or higher.

Chapter 4

The relationship between family characteristics, home environment, and mathematics performance

Parental education, occupation, and student performance

As shown in Chapter 1, the mathematics performance of students differed considerably across countries and across provinces. The previous chapter discussed how these differences may be related to attitudes and perceptions of students. This chapter examines two important family characteristics – parental education and occupation – and how they relate to overall mathematics performance.

Parents play an important role in how students learn. Aside from being actively involved in their childrens' education, parents also provide a home environment that can impact learning. Parents serve as a model for learning, determine the educational resources available in the home, and hold particular attitudes and values towards education. Although it is difficult to examine the home environment of each student, the educational attainment and occupation of parents reflect the values and resources with which parents create this environment.

Parental education and occupation are two major components of the *socio-economic status* (SES) of a student. The association between student SES and test performance describes the relative advantage or disadvantage that can be explained by family circumstances. Just as each student can be described by his or her home environment, so can a school be described by the family background of its students (school socio-economic background).

This chapter begins with an examination of the relationships of parental education and occupation to overall mathematics performance. The next section looks to see if the relationship between socio-economic background and mathematics performance differs across provinces. The chapter ends with a discussion of how schools and school systems may moderate the effects of individual socio-economic background.

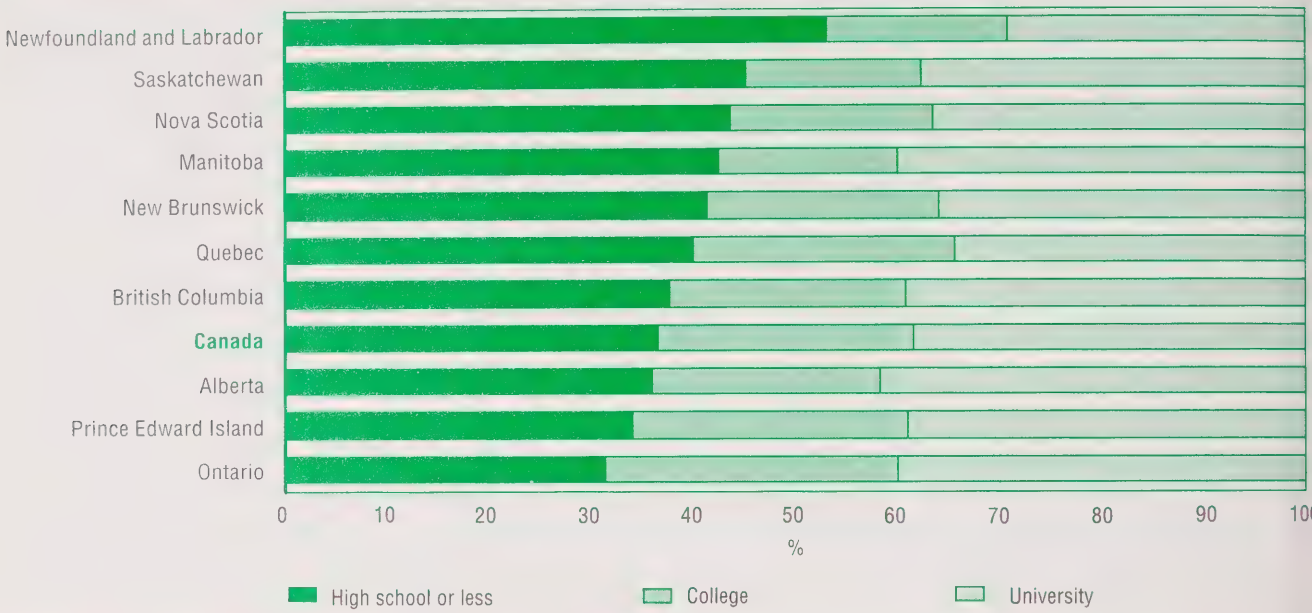
High parental education is associated with higher mathematics performance

In PISA 2003, students were asked to indicate the highest level of education attained by each of their parents/guardians. The categories were: No education, Elementary school, Junior high or middle school, High school, College, and University. In Canada, very few parents were reported to have less than high school education. Therefore, the lowest four categories were grouped together as High school or less. The highest

level of parental education for a family is considered. For example, for a student whose father had a college diploma and whose mother had a university degree, the level of parental education would be university. Figure 4.1 shows the proportion of students in each province with each level of parental education.

Figure 4.1

Parental educational attainment in Canadian provinces.



The results displayed in Figure 4.1 illustrate the education levels of the adults that 15-year-olds in each province and Canada overall are most likely to encounter in their everyday lives (their own parents and the parents of their peers). The proportions at each level of education can be described as the educational context of 15-year-olds in each province. The value of education may be reinforced when students are surrounded by adults who demonstrate its worth by investing the necessary time and money (e.g., direct costs such as tuition fees, cost of books, room and board, and indirect costs such as lost wages during the time of study) to pursue higher education. This context was different across provinces. In Newfoundland and Labrador, over half of the students had parents whose highest educational attainment was high school or less. In contrast, four of every ten students had at least one parent with a university education in Alberta, Ontario, and Manitoba.

Students whose parents had a higher level of education tended to perform better in mathematics than students whose parents had a lower level of education. For Canada as a whole, the average score of students whose parents had high school or less was 515, while the average performance of the students whose parents had college level and university education were, respectively, 531 and 553. The difference in average performance between students whose parents had university education versus high school or less was around two-thirds of a proficiency level. These results suggest a positive relationship between the educational level of the parents and the performance of their children in mathematics. This relationship is displayed in Figure 4.2. Each bar shows the performance of typical students within each level of parental education in each province. The length of each bar represents the range of mathematics scores between the 25th percentile and the 75th percentile in each group. Therefore, each bar represents 50% of students, while 25% scored below the bottom limit of the bar and 25% scored above the top limit.

Figure 4.2

Parental education and student performance in mathematics in Canadian provinces

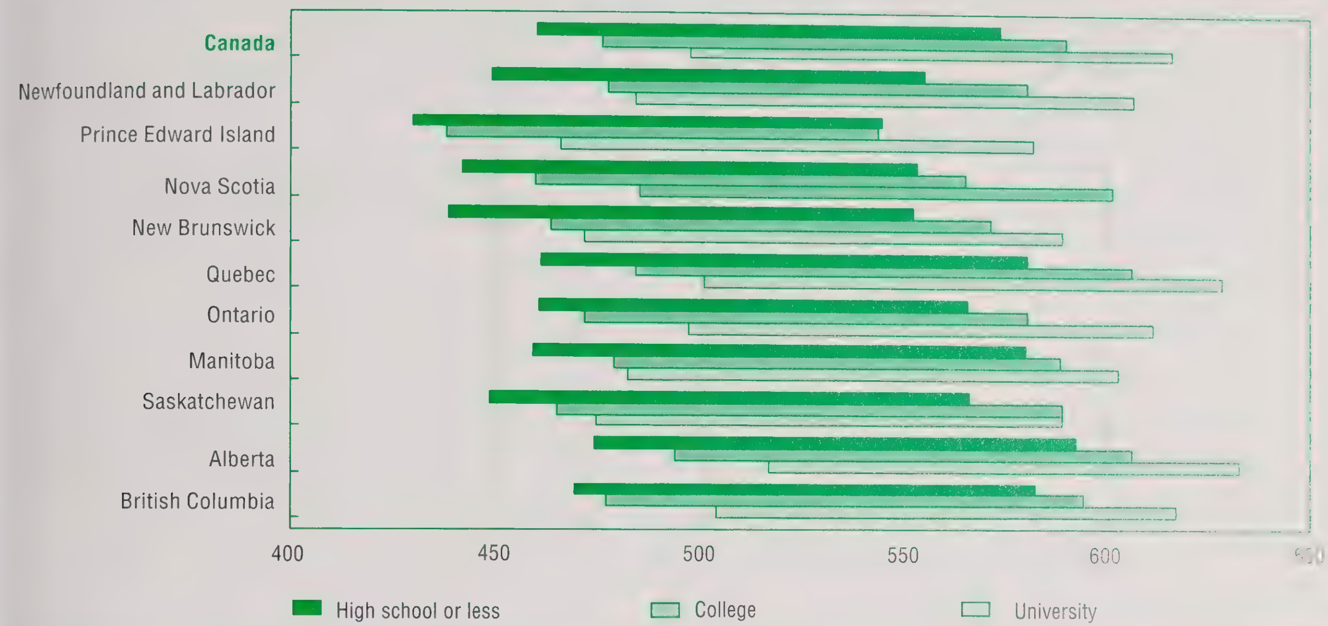
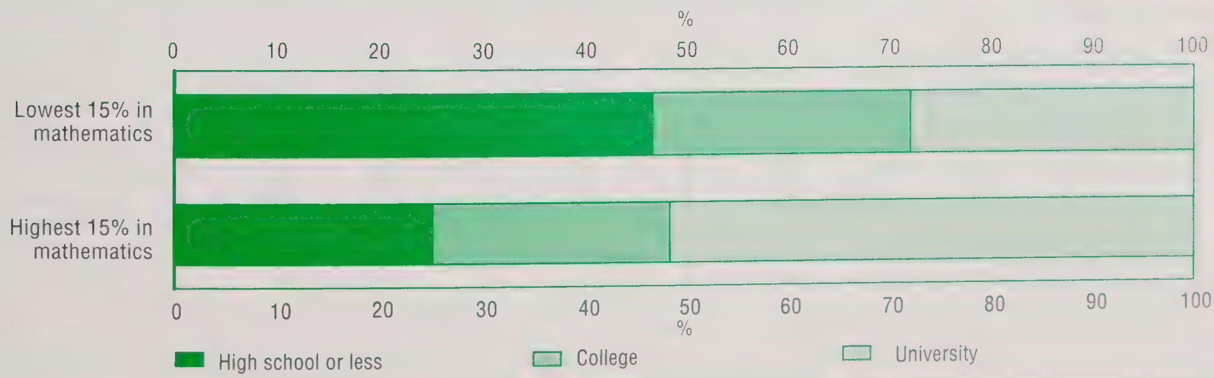


Figure 4.2 reveals that, while higher parental education tended to be associated with higher mathematics performance, there was substantial overlap of performance between the different levels of parental education. Many students whose parents had high school education or less outperformed students whose parents had university education. Given the wide range of student performance within each group, it is clear that the success of many students appears to be dependent on factors other than their parents' level of education. For example, as shown in Figure 4.3, although most of the students whose performance was in the top 15% of students had at least one parent with a university education, one in four of these highest performing students had parents with only high school or less. Further, one in four of the students whose performance was in the bottom 15% also had at least one parent with a university degree.

Figure 4.3

Parental education of high and low performing students in Canada



Parental occupation is related to the skills used by parents

In PISA 2003, students were asked to report the occupations held by both their mother and father. These occupations have been grouped into six categories according to the types of skills that are associated with each occupation (see text box 'Describing Parental Occupation with the International Standard Classification of Occupation (ISCO)'). Some examples of the occupations that characterise each category are provided as follows:

- **Higher service:** lawyers, scientists, executive officers of large corporations and divisional managers
- **Lower service:** laboratory technicians, midwives, computer programmers, insurance salespersons, real estate brokers, managers of small businesses
- **Routine clerical/sales:** administrative assistants, client information clerks, cashiers, sales assistants
- **Skilled manual:** carpenters, welders, jewellery makers, upholsterers, engine machinists
- **Semi-unskilled manual:** manufacturing machine operators, taxi drivers, building cleaners
- **Farmers/ farm managers:** supervisory farm workers, self-employed farmers

Describing Parental Occupation with the International Standard Classification of Occupation (ISCO)

PISA 2003 asked students if their parents were working, and if so, what type of work they did. The responses were then assigned to specific categories in a classification system called the International Standard Classification of Occupation (ISCO). ISCO uses a four-digit code to describe different occupations, where each digit represents a particular group of occupations within a broader group. The first digit in ISCO distinguishes ten major groups:

1000	*Legislators, Senior Officials and Managers*
2000	*Professionals*
3000	*Technicians and Associate Professionals*
4000	*Clerks*
5000	*Service Workers and Shop and Market Sales Workers*
6000	*Skilled Agricultural and Fishery Workers*
7000	*Craft and Related Trades Workers*
8000	*Plant and Machine Operators and Assemblers*
9000	*Elementary Occupations*
0000	*Armed Forces Personnel*

Within these groups, there are 28 sub-major groups, 116 minor groups and 390 unit groups. Each of the groups and units are defined by the specific skills associated with the occupations rather than industry or income. This framework allows ISCO to describe the activities of each person's occupation. The level of description may be very specific, depending on the number of ISCO digits used. For example, the specific occupation *Computer systems designers, analysts and programmers* has a four-digit ISCO code of 2131; it falls within the three-digit minor group of *Computing professionals* (2130) and also within the sub-major group of occupations *Physical, mathematical and engineering science professionals* (2100).

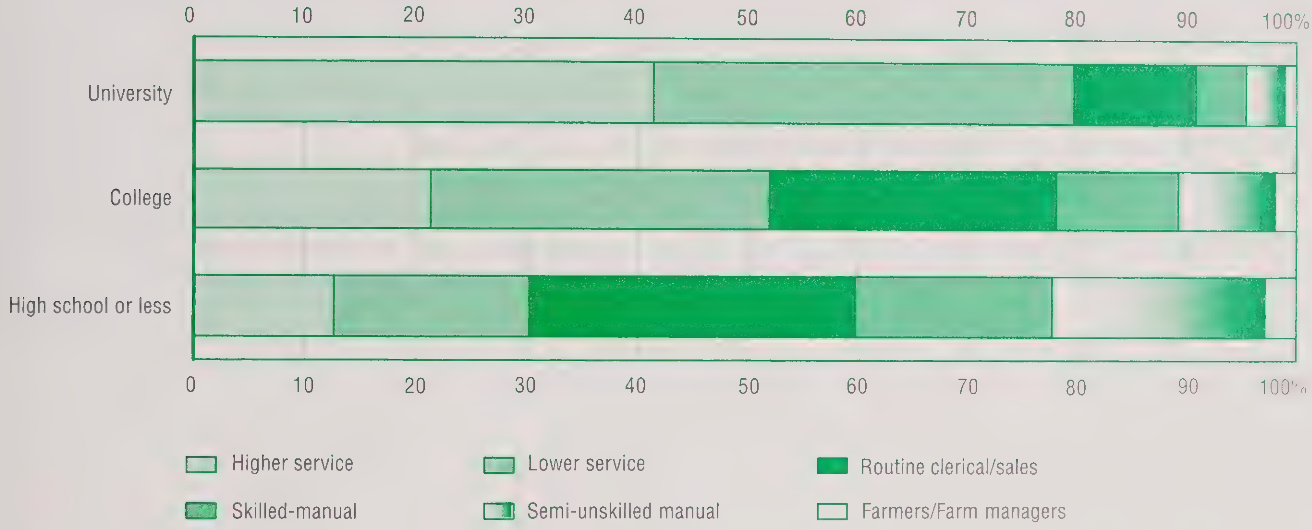
Using the detailed information provided by ISCO, several methods have been developed to translate the ISCO categories into categories that can be used to further group or order individuals according to the social status, prestige, or skill level associated with their occupations. This chapter uses two of the methods described in Ganzeboom and Treiman (1996)[1]. The first, referred to as the EGP classification, first identifies workers according to whether their occupations are manual or non-manual. Within these two broad groups, workers can have varying skill levels or be self-employed or not. Only six of the 11 EGP categories (1, 2, 3, 8, 9, 11) are used in this report. These groups accounted for the parental occupations of 97% of Canadian 15-year-olds. The second method, referred to as the International Socio-economic Index (ISEI), adapts the ISCO framework to describe the status associated with each occupation. Social status has been defined as the degree to which each occupation converts education into earnings. For example, occupations which tend to reward higher-educated individuals are associated with higher status. Conversely, occupations where earnings are not strongly related to education have lower status. For students with more than one working parent, highest occupational status was used to assign a single parental occupation. This measure has been used with other indicators to create the overall index of *socio-economic status* associated with each student's home environment.

1. Ganzeboom, H.B.G. & D.J. Treiman. 1996. "Internationally comparable measures of occupational status for the 1988 International Standard Classification of Occupations." *Social Science Research. 25:201-239*

Parental occupation is an indicator of the education-related skills used by parents. The relationship between parental education and occupation is illustrated in Figure 4.4. As the level of parental education attainment increased, parents of 15-year-olds were more likely to participate in service occupations with both high and low skill requirements, and were less likely to participate in routine or manual occupations. Conversely, individuals with lower education were more likely to be manual worker and self-employed farmers, both skilled and unskilled. This relationship between education and occupation is not surprising, because many service and professional occupations also have specific education or certification requirements.

Figure 4.4

Parental educational attainment and occupation

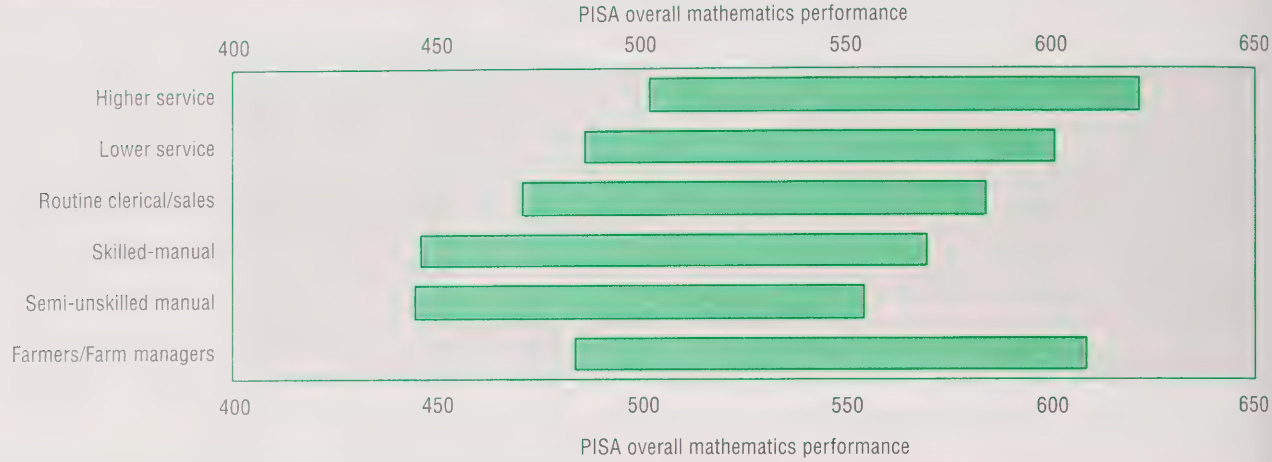


Parental occupation may influence student performance in many ways. For example, occupation-related income may determine access to learning opportunities and resources thus impacting learning outcomes. The role of education and the types of skills associated with different occupations and modeled by parents may motivate students to develop their own skills in particular ways. Parental occupation may also influence how students perceive the value of mathematics learning, their beliefs about the usefulness of mathematics, and the learning environment at home.

The relationship between student mathematics performance and parental occupational category is shown in Figure 4.5. Each bar represents the range of mathematics scores between the 25th and 75th percentiles. If occupation is considered as an indicator of parental skill use, it appears that students whose parents worked in occupations with greater skill requirements also performed better in mathematics. However, the large overlap between groups also indicates that there are still large differences within each occupational category. Some of these differences may be explained by the specific skills parents use in their occupations.

Figure 4.5

Parental occupation and student mathematics performance in Canada



To illustrate this point, the average mathematics performance of students with selected parental occupations defined using the International Standard Classification of Occupation (ISCO) is displayed in Table 4.1. The ISCO sub-major group 2100 (Physical, mathematical & engineering science professionals) is the only occupational group characterised specifically by the use of advanced mathematics. The other four occupational groups selected for this comparison are professional or managerial occupations typically associated with at least a college education and higher-than-average income. Even among these relatively advantaged students, those whose parents had occupations that specifically require mathematics skill (group 2100) tended to perform higher than other students.

Table 4.1

Mathematics performance of students with parents in high-skill service occupations

ISCO group	Description of typical occupations	Average	Standard error
2100	Physical, mathematical and engineering science professionals	598	(8.23)
2300	Teaching professionals	581	(5.10)
2200	Technicians and associated professionals	561	(2.93)
1000	Legislators, senior officials, executives and managers	549	(3.60)
3000	Life science and health professionals	547	(5.06)

Although parental income may result in greater opportunities and resources, it appears to play a secondary role to the skill use associated with parental occupation. For example, occupations in the ISCO major group 1000 (legislators, senior officials, executives and managers) are associated with higher income than most other occupations[22]. However, students with parents in this group performed almost one proficiency level lower than those with parents whose occupations were directly related to mathematics use.

Looking at occupation highlights the importance of home environment in developing the skills of students. Like parental education, parental occupation is an indicator of the influences present in the home of each student. Although many other factors contribute to a child's home environment, examination of these variables reinforces the idea that parental role modeling may be an important influence on a student's learning. To better understand the role of the home environment for mathematics performance, the section below examines a summary measure of the resources, possessions, and values in each student's home called *socio-economic status* (SES) and its relationship with student performance.

Socio-economic status and student performance

Socio-economic status (SES) is a term used to summarise a variety of factors, including parental education and occupation, which influence student performance. In PISA 2003, SES is measured by an index that includes information describing family structure, parental education and occupation, parental labour market participation, and whether a student's family has specific educational and cultural possessions at home. This index is standardized to have an average of 0 and standard deviation of 1 across all OECD countries.

The averages of SES for Canada and the provinces are reported in Table 4.2. The average student in Canada had a relative socio-economic advantage compared to 15-year-olds in all OECD countries combined. There were substantial differences in the distributions of SES between provinces. As shown in Table 4.2, the provinces can be divided into three groups in terms of SES. Alberta, British Columbia, and Ontario comprise one group, characterised by average SES higher than the Canadian average. The second group includes the wide range of average SES in Manitoba, Saskatchewan, Nova Scotia, Prince Edward Island, and Quebec that was slightly lower than Canada overall. The last group contains New Brunswick and Newfoundland and Labrador with average SES much lower than Canada. Although students in all provinces tend to be more advantaged than 15-year-olds in all OECD countries combined, the differences across provinces suggest that all students in Canada may not have access to the same resources or opportunities.

Table 4.2

Socio-economic status in Canadian provinces

	Index average	Standard error	Standard deviation
Canada	**0.45**	**(0.02)**	**0.82**
Alberta	0.58	(0.05)	0.81
British Columbia	0.52	(0.03)	0.80
Ontario	0.52	(0.03)	0.74
Manitoba	0.37	(0.03)	0.82
Saskatchewan	0.35	(0.03)	0.80
Nova Scotia	0.34	(0.02)	0.83
Prince Edward Island	0.31	(0.02)	0.84
Quebec	0.30	(0.03)	0.83
New Brunswick	0.25	(0.01)	0.85
Newfoundland and Labrador	0.25	(0.02)	0.89

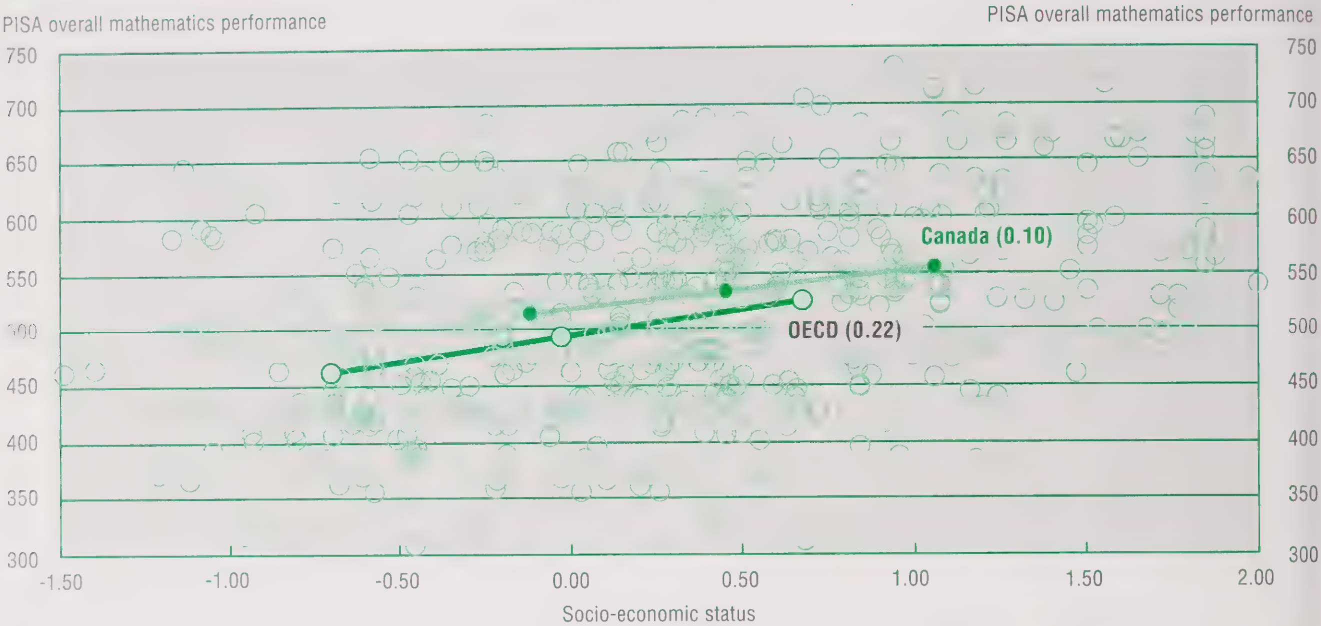
Socio-economic gradients show that some provincial differences in performance can be explained by differences in socio-economic conditions

Students with higher SES tended to perform better in mathematics than students with lower SES, but there were also large differences in performance among students with similar SES. This relationship is illustrated in Figure 4.6. The pattern of dots, or the *scatter plot*, is illustrated using the socio-economic backgrounds and mathematics scores of 500 randomly selected Canadian students. The relationship between SES and performance in mathematics for students in Canada is represented by the solid line passing through the centre of this scatter plot. This line predicts the mathematics performance of students based on their level of SES. The endpoints of the line are the 25th and 75th percentiles of SES. Therefore, the line represents the relationship and distribution of SES and mathematics performance of a typical range of students. The dashed line illustrates the relationship for students in all OECD countries combined.

These lines are referred to as *socio-economic gradients*, because they summarise the impact of socio-economic status on student performance. The OECD gradient is longer because Canadian students are much more similar to each other in terms of SES than are other students in the OECD. The slope of the OECD gradient is greater than that of the Canadian gradient because the differences in performance of students with different levels of SES are greater in the OECD than in Canada. The strength of the relationship between SES and performance, given in parentheses, is measured on a scale from 0 to 1. The value of 0.10 for Canada indicates that 10% of the variance in student performance in Canada can be explained by SES. If SES were a perfect predictor of performance in Canada, the strength of the gradient would be 1 and all points would lie on the gradient. However, at every level of SES in Canada, there is still substantial variability in student performance. In the OECD, 22% of the differences in performance of students in OECD countries are explained by SES, indicating a much stronger gradient. The shorter line, shallower slope and lower strength of the Canadian gradient indicate that students in Canada tend to have a more equitable distribution of resources and that differences in the level of these resources do not matter as much to performance in Canada as in OECD countries overall.

figure 4.6

Socio-economic gradients for Canada and the OECD



Gradients may be used to examine the extent to which groups of students perform differently from other groups due to differences in SES. At all comparable levels between the 25th and 75th percentiles, the Canadian gradient is higher than the OECD gradient, suggesting that most students in Canada performed better, on average, than students in OECD countries regardless of SES. However, the two gradients are not parallel. At higher levels of SES, the OECD countries gradient becomes closer to the Canadian gradient and, if it were to be extended further, would intersect Canada's gradient around the SES value of 1.00. The closeness of the gradients at high levels of SES suggests that high SES students perform similarly, regardless of whether they attend school in Canada or on average OECD countries. Thus, some of the difference in average performance between the OECD countries and Canada can be explained by a) the greater relative disadvantage of low-SES students in the OECD, and b) the lower SES of students in OECD countries overall.

Across most Canadian provinces, the gradients are similar in length, slope and strength to the gradient for all Canadian students (Figure 4.7). This similarity suggests that, in all provinces, the disparity in performance between students of different SES is of similar magnitude. In most provinces, around 10% of the differences in student performance can be explained by differences in SES. The exception is Manitoba, where the relationship is less pronounced, and Newfoundland and Labrador, where the relationship is more pronounced.

The relative positions of the gradients illustrate how provincial differences in SES relate to differences in performance. Alberta's higher levels of SES are associated with higher average performance, but its gradient does not overlap or intersect any others, suggesting that students in Alberta would still perform better on average than students in other provinces with comparable levels of SES. The closeness of the Quebec gradient to Alberta's suggests that performance in Quebec would be more comparable if Quebec students had similar SES as their peers in Alberta. Although British Columbia had a higher average performance than Quebec, the gradient in British Columbia is lower than that in Quebec at all levels of SES. This comparison suggests that the high performance of students in British Columbia is related to their higher-than-average SES. The gradients of Newfoundland and Labrador, Ontario, Saskatchewan, Nova Scotia and New Brunswick intersect, despite having similar slopes, indicating that much of the difference between these provinces in average performance may be explained by differences in their distributions of SES.

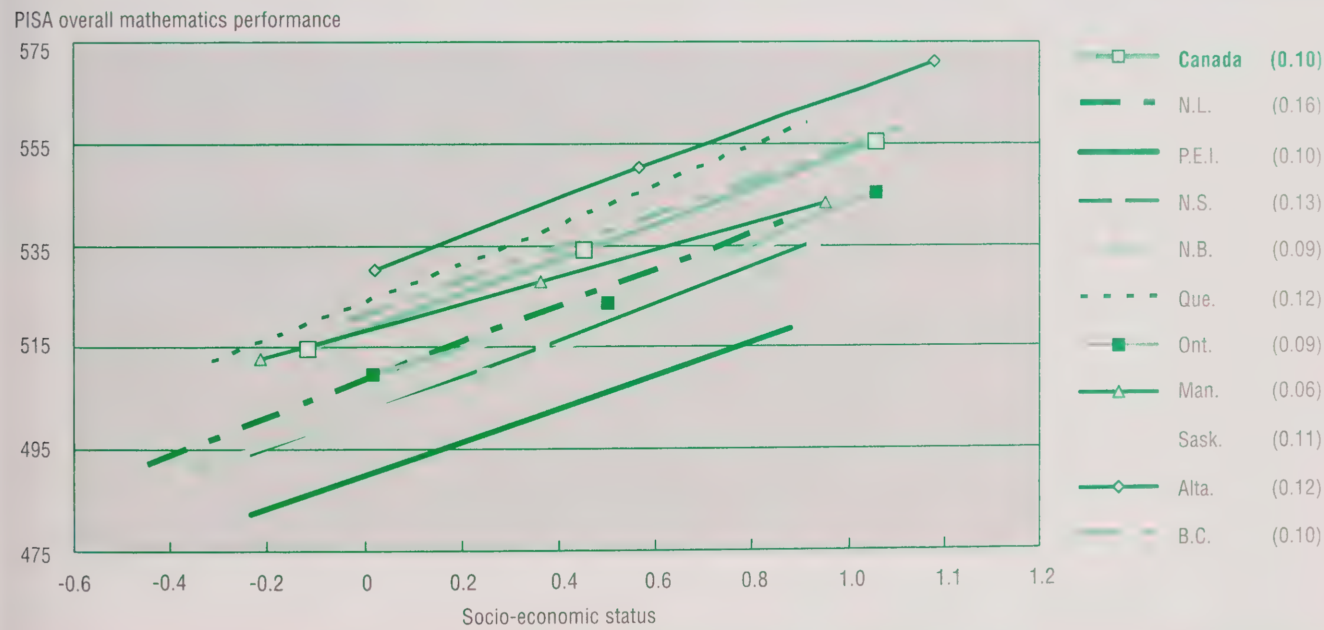
The low position of the gradient in Prince Edward Island indicates that students in Prince Edward Island tend to perform lower than students in other provinces regardless of their level of SES.

The socio-economic composition of schools can help or hinder student learning by compounding the effect of individual SES

Both theory and empirical evidence suggest that students' knowledge and behaviour, including academic outcomes, are influenced by the characteristics of the schools they attend. Schools can be characterized by the socio-economic composition of their student population. Schools may have higher or lower average SES, depending on whether their students are predominantly from low or high SES families. Schools may also differ in how they mix students from different backgrounds. Schools are more segregated if most of the students tend to have the same level of SES or more inclusive if students come from a variety of backgrounds. To some extent, the socio-economic background of the school population may reflect the socio-economic conditions of the community where the school is located and thus be a community characteristic as well as a school characteristic. In other jurisdictions, however, it may also be the result of administrative decisions affecting student intake, either through the definition of school catchment areas or the degree to which students and families are able to choose schools and school programs.

Figure 4.7

Socio-economic gradients for Canadian provinces



Earlier in this chapter, the importance of SES was discussed. However, schools play an important role in moderating the effects of individual SES. Figure 4.8 shows the typical range (25th to 75th percentiles) of mathematics scores of students in schools with different socio-economic composition after controlling for individual socio-economic background. Schools were grouped into the lowest, middle, and highest thirds of average SES. Even if all students had similar socio-economic backgrounds, students tended to perform better, on average, in schools with higher average SES. This tendency suggests that students are not only affected by the socio-economic circumstances of their own parents, but by those of their peers as well. This may have a positive effect for students surrounded by positive peer influences and role models, but it may also doubly-disadvantage students from lower SES families attending school with other students from similar backgrounds.

However, there is a great deal of overlap in the distributions, indicating that even if all students and schools had similar SES, there would still be differences in student performance.

Summary

The results from this chapter revealed that the home environment of a student is related to mathematics performance. In all provinces, students whose parents had a university education performed almost a full proficiency level higher than those whose parents had high school or less. However, there were still many Canadian students whose parents had high school or less with higher mathematics scores than students with university-educated parents. Parental education is associated with, but does not determine, performance for students.

Parental occupation was also related to the mathematics performance of students. Specifically, students whose parents had occupations requiring advanced mathematics skills performed over a full performance level higher than other students whose parents had occupations associated with similar education and income. These results suggest that the value of skills modeled by parents through pursuit of education and occupations may have a greater influence on student performance than the income or prestige associated with the attainment of these goals.

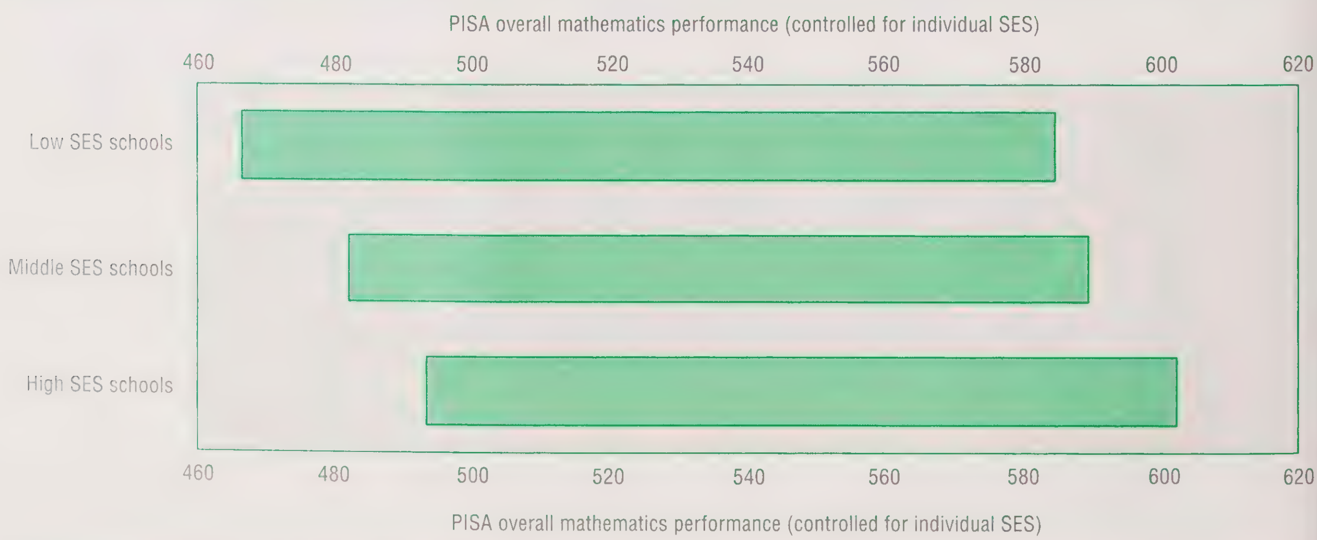
Parents may also model the value of skills and learning by developing a positive home environment for their children. Such an environment includes role models who demonstrate the value of skills and learning as well as resources and opportunities to learn. Socio-economic status (SES) was used as a measure to describe the relative advantage associated with a student's home environment. Canadian students tend to be more advantaged than students in all OECD countries combined, but students in some provinces are more advantaged than others. In every province, students with higher SES tend to perform better in mathematics. Furthermore, students tend to have better performance when they attend schools with students from high SES backgrounds, regardless of their own families' SES.

Note

22. Statistics Canada. 2003. Earnings of Canadians, 2001 Census. Catalogue no. 97F0019XCB2001000. Ottawa.

Figure 4.8

School socio-economic status (SES) and student performance in mathematics in Canada



Conclusion

Ensuring that Canadian students acquire the skills and knowledge to participate fully in a knowledge-based economy and society is a goal shared by all levels of government and by the Canadian population. Will Canadian youth be well equipped to compete in tomorrow's economy? Have they developed a foundation of knowledge and skills for lifelong learning?

The OECD Programme for International Student Assessment (PISA) was first conducted in 2000. It compares how 15-year-old students from Canada perform in three domains - mathematics, reading, and science - in comparison with their peers from other countries. Each PISA assessment provides more detailed information on one of the three domains. Reading was the major domain in 2000 and mathematics in 2003. In addition to having reading and science as minor domains, the 2003 assessment also assessed problem-solving skills.

The PISA 2000 results were positive for Canada since the students' performances were among the highest and most equitably distributed. Results from this report on PISA 2003 also show that 15-year-old students in Canada performed well in all four domains assessed, relative to their international peers.

Canadian 15-year-olds performed well in mathematics

Students from only two countries (Hong Kong-China and Finland) outperformed Canada's 15-year-olds in mathematics. The PISA 2003 design allowed for an examination of four sub-domains corresponding to four content areas in mathematics: *space and shape; change and relationships*, *quantity*, and *uncertainty*. Canadian students performed less well in the *space and shape* sub-domain relative to their performance in the three other sub-domains. They were outperformed by eight countries in *space and shape* compared to only one or two countries in the other sub-domains. Further study is needed to understand why the performance of Canadian students was lower in *space and shape* relative to the other three sub-domains.

The mathematical abilities of students are also described using six proficiency levels. A higher proportion of Canadian students performed at the two highest proficiency levels (Levels 5 and 6) compared to the OECD average. Furthermore, a lower proportion of 15-year-old Canadians performed at Level 1 or below. Using these proficiency levels, it is also possible to express the differences not only in terms of statistical significance, but also in terms of differences in mathematical abilities. The difference between the country with the highest overall mathematics result (Hong Kong-China) and the result for Canada is equivalent to less than a third of a proficiency level. On the other hand, Canadian 15-year-old students scored more than half a proficiency level above the OECD average.

It is possible to compare performance in the two mathematics sub-domains included in both PISA 2000 and 2003. For Canada and most countries for which a comparison is possible, there was no change in the performance on *space and shape* while there was an improvement in the performance on *change and relationships*.

At the provincial level, all provinces performed at or above the OECD average in mathematics. Furthermore, students from Alberta, British Columbia, and Quebec performed as well as those from the top performing countries. Examining provincial results in mathematics by proficiency levels reveals some important differences. Students from Alberta performed around half

a proficiency level higher, or more, than students from Newfoundland and Labrador, Saskatchewan, Nova Scotia, New Brunswick, and Prince Edward Island on the combined mathematics scale. On the other hand, students from Prince Edward Island were outperformed by about half a proficiency level or more by students from Manitoba, Ontario, Quebec, British Columbia, and Alberta.

Between 2000 and 2003, Canadian students' performance remained unchanged in reading but was lower in science

Canadian 15-year-olds also performed well in the other domains measured by PISA. Only Finland outperformed Canada in reading, while four countries outperformed Canada in science and problem solving (Finland, Japan, Hong Kong-China, Korea).

Compared with PISA 2000, the average reading performance of Canadian 15-year-olds remained unchanged in PISA 2003. On the other hand, the average science performance was lower in PISA 2003. While this decrease cannot be seen as a trend, it warrants further analysis. Since science will be the major domain of PISA 2006, the third cycle of PISA will provide additional insight on how well equipped Canadian students are in this domain, will allow for a relative estimate of trend in performance, and will provide additional insight into the factors associated with science performance.

All provinces did well in the three minor domains of reading, science, and problem solving and performed at or above the OECD average with one exception: Prince Edward Island performed below the OECD average in science. In fact, students from Alberta performed equally well as students from the top performing countries in all three domains. Similarly, the performance of the students from British Columbia was as good as students from the top performing countries in reading. Although most provinces performed at or above the OECD average, differences in performance among the provinces in all four PISA domains raise interesting questions of equity across Canada.

Boys significantly outperformed girls in mathematics, but the magnitude of the difference is small

Another matter that warrants further analysis is the gender difference in performance. In 27 countries, including Canada, boys' outperformed girls in mathematics. However, it should be noted that the magnitude of the difference in Canada was small, representing only about a sixth of a proficiency level. Furthermore, there was no detectable difference between boys and girls in three provinces (Prince Edward Island, Quebec, and Saskatchewan).

As was the case in PISA 2000, there was a relatively large difference favouring girls in reading. This difference was significant in all but one country and in all provinces. As was the case with mathematics, boys performed significantly higher than girls in science in Canada overall. However, among the provinces, the difference was significant in Nova Scotia, Ontario and Manitoba. There was no gender difference in problem solving in Canada and in most provinces.

Differences in performance between students in the French-language and English-language school systems varied by province and subject

Except for Ontario, there was no difference in the mathematics performance between students in the English-language and French-language school systems.

In Ontario, students in the French-language school system performed lower than their peers in the English-language school system in mathematics as well as in reading, science, and problem solving. On the other hand, in Quebec there was no difference between the French-language and English-language school systems in any of the domains assessed.

The performance of students in the French-language school system from New Brunswick and Nova Scotia was lower in reading, science and problem solving as was the performance of students from the French-language school system in Manitoba in reading and science.

Mathematics confidence and anxiety are strongly related to achievement

The results presented in this report also reveal that student engagement in mathematics is related to achievement. In fact, students with high mathematics confidence performed around two proficiency levels higher than did students with low confidance. Furthermore, students with high mathematical anxiety performed the equivalent of one proficiency level lower than students with low anxiety. These results suggest that high Mathematics confidence and low mathematics anxiety may be important outcomes on their own.

Family background characteristics are related to student performance

Family background characteristics were also related to student performance in mathematics. In all provinces, 15-year-old students whose parents had a university degree performed about two-thirds of a proficiency level higher than those whose parents had high school education or less. Additionally, students whose parents had an occupation requiring advanced mathematics performed almost one proficiency level higher than other students whose parents had occupations associated with similar education and income but whose occupation did not require advanced mathematics.

Students from families with higher socio-economic status also tended to perform better in mathematics. However, socio-economic status had a smaller impact on mathematics achievement in Canada than in all OECD countries combined.

The socio-economic composition of schools influences mathematics achievement

Students who attended schools with students from higher socio-economic status (SES) backgrounds performed better in mathematics regardless of the SES of their family. This finding suggests that students are not only affected by the socio-economic circumstances of their own parents, but by those of their peers as well. However, there is a great deal of overlap in the distributions of student performance by the socio-economic composition of the schools they attend. This finding indicates that even if all students and schools had similar socio-economic status, there would still be differences in student performance.

The performance of Canadian 15-year-olds merits recognition yet also raises some concerns. Overall, when compared with their peers in other participating countries, Canadian students did well on the PISA 2003 assessment. However, significant provincial differences in many domains exist. Furthermore, the relatively lower performance in the *space and shape* sub-domain and the science domain as well as the lower performance in science between PISA 2000 and PISA 2003 is noteworthy. Nevertheless, the performance of Canadian youth in the PISA assessment is promising to their future and the future of Canada.

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Appendix A

PISA sampling procedures and response rates

The accuracy of PISA survey results depends on the quality of the information on which the sample is based as well as the sampling procedures. The PISA sample for Canada was based on a two-stage stratified sample. The first stage consisted of sampling individual schools in which 15-year-old students were enrolled. Schools were sampled systematically with probabilities proportional to size, the measure of size being a function of the estimated number of eligible (15-year-old) students enrolled. A minimum of 150 schools were required to be selected in each country. In Canada, a much larger sample of schools was selected in order to produce reliable estimates for each province and for each of the language systems in the five provinces where these populations were separately sampled (Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba).

The second stage of the selection process sampled students within sampled schools. Once schools were selected, a list of each sampled school's 15-year-old students was prepared. From this list, 35 students were then selected with equal probability. All 15-year old students were selected if fewer than 35 were enrolled. Additionally, in Prince Edward Island, Nova Scotia and New Brunswick and in the French-language school system in Manitoba, more than 35 students were selected in order to meet sample size requirements.

In order to minimize the potential for response bias, data quality standards in PISA require minimum participation rates for schools and students. At the national level, a minimum response rate of 85% was required for schools initially selected. School response rates were also considered acceptable where the initial school response rate was between 65% and 85% and replacement schools were used to achieve a school response rate of 85% or higher. Schools with student participation rates between 25% and 50% were not counted as participating schools, but data for these schools were included in the database. Schools with student participation rates of less than 25% were not counted as participating and their data were excluded from the database.

PISA also requires a minimum student participation rate of 80% within all participating schools combined (original sample and replacements) at the national level.

Table A1 shows the response rates for schools and students, before and after replacement, for Canada and the 10 provinces. At the national level 1,162 schools were selected to participate in PISA and 1,040 of these initially selected schools participated. Rather than calculating school participation rates by dividing the number of participating schools by the total number of schools, school response rates were weighted based on 15-year-old enrollment numbers in each school.

With the exception of Ontario, school response rates across the provinces were 95% or higher. In Ontario, the school response rate was 64.3% after replacement.

Table A1

PISA 2003 school and student response rates

Provinces	Total number of selected schools (participating and not participating)	School response rate before replacement		School response rate after replacement		Total number of students sampled (participating and not participating)		Total number of students participating		Weighted student participation rate after replacement (%)
		N	weighted %*	N	weighted %*	un-weighted	weighted	un-weighted	weighted	
Newfoundland and Labrador	111	108	98.8	108	98.8	2,606	5,913	2,301	5,215	88.2
Prince Edward Island	26	26	100.0	26	100.0	1,832	1,832	1,653	1,653	90.2
Nova Scotia	118	117	98.8	117	98.8	3,308	10,274	2,871	8,917	86.8
New Brunswick	76	76	100.0	76	100.0	4,209	8,341	3,781	7,480	89.7
Quebec	138	131	96.9	131	96.9	3,918	71,373	3,357	61,286	85.9
Ontario	202	116	53.2	138	64.3	4,055	81,701	3,230	63,673	77.9
Manitoba	126	117	93.7	120	95.9	3,108	12,217	2,778	10,605	86.8
Saskatchewan	122	112	95.2	112	95.2	2,657	11,939	2,350	10,478	87.8
Alberta	119	115	94.9	116	95.2	2,777	34,504	2,442	29,587	85.8
British Columbia	124	122	98.9	122	98.9	3,429	40,622	2,949	34,935	86.0
Canada	**1,162**	**1,040**	**80.0**	**1,066**	**84.4**	**31,899**	**278,716**	**27,712**	**233,829**	**83.9**

School response rates were weighted based on 15-year-old enrollment

As response rates were lower than anticipated in Ontario, a detailed analysis was undertaken in this province to detect whether non-participation of schools was concentrated in one specific area, i.e. if there appeared to be a bias. To do this, the distribution of the non-participating schools was examined by school size and sector (French and English), by urban/rural and by public/private sector. Information on these characteristics was available for all schools, whether they participated in PISA or not. There were no differences in the distribution of various characteristics between in-scope schools and participating schools. Further analysis revealed that the distribution of schools by school board was similar for both in-scope schools and responding schools and that non-response was not concentrated within particular school boards. Consequently, among the variables that were available for analysis, there was no evidence of bias between responding and non-responding schools.

This analysis was shared with the international PISA consortium that validated the quality of the Canadian database and concluded that the Canadian data were of good quality.

Appendix B

Tables

The enclosed tables are based on the Organisation for Economic Cooperation and Development Programme for International Student Assessment, 2003.

The *standard error* associated with the estimates presented is included in parenthesis. The *confidence interval*, when presented, represents the range within which the score for the population is likely to fall, with 95% probability.

Several tables in this publication present average scores along with standard errors for these averages. In order to estimate whether two means are significantly different, the following method explains how to use the published standard errors to approximate a 95% confidence interval.

Approximate Confidence Interval = average score +/- 1.96 x Standard Error

This rough confidence interval gives a range within which the true mean is likely to fall. If two confidence intervals overlap, then there is no significant difference between the means. It should be noted that this guide will allow you to determine significance with only **about** a 95% level of confidence. As a result, by using this rule of thumb, there is a small risk that cases where the difference is significant (but very small) are not identified.

In some tables the performance of countries and provinces relative to Canada has been indicated as being higher, the same, or lower using the following legend.

Performed significantly higher than Canada	Performed the same as Canada	Performed significantly lower than Canada

Table B1.1

Estimated average scores and confidence intervals for provinces and countries: COMBINED MATHEMATICS

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Hong Kong-China	550	(4.5)	541	559
Alberta	549	(4.3)	540	557
Finland	544	(1.9)	541	548
Korea	542	(3.2)	536	549
British Columbia	538	(2.4)	534	543
Netherlands	538	(3.1)	532	544
Quebec	537	(4.7)	528	546
Liechtenstein	536	(4.1)	528	544
Japan	534	(4.0)	526	542
Canada	**532**	**(1.8)**	**529**	**536**
Ontario	530	(3.6)	523	537
Belgium	529	(2.3)	525	534
Manitoba	528	(3.1)	522	534
Macao-China	527	(2.9)	522	533
Switzerland	527	(3.4)	520	533
Australia	524	(2.1)	520	528
New Zealand	523	(2.3)	519	528
Newfoundland and Labrador	517	(2.5)	512	522
Saskatchewan	516	(3.9)	509	524
Czech Republic	516	(3.5)	510	523
Nova Scotia	515	(2.2)	511	519
Iceland	515	(1.4)	512	518
Denmark	514	(2.7)	509	520
New Brunswick	512	(1.8)	508	515
France	511	(2.5)	506	516
Sweden	509	(2.6)	504	514
Austria	506	(3.3)	499	512
Germany	503	(3.3)	496	509
Ireland	503	(2.4)	498	508
Prince Edward Island	500	(2.0)	496	504
Slovak Republic	498	(3.3)	492	505
Norway	495	(2.4)	491	500
Luxembourg	493	(1.0)	491	495
Poland	490	(2.5)	485	495
Hungary	490	(2.8)	484	496
Spain	485	(2.4)	480	490
Latvia	483	(3.7)	476	491
United States	483	(2.9)	477	489
Russian Federation	468	(4.2)	460	477
Portugal	466	(3.4)	459	473
Italy	466	(3.1)	460	472
Greece	445	(3.9)	437	453
Serbia and Montenegro (Ser.)	437	(3.8)	430	444
Turkey	423	(6.7)	410	437
Uruguay	422	(3.3)	416	429
Thailand	417	(3.0)	411	423
Mexico	385	(3.6)	378	392
Indonesia	360	(3.9)	352	368
Tunisia	359	(2.5)	354	364
Brazil	356	(4.8)	347	365

Note: The OECD average is 500 with a standard error of 0.6.

Table B1.2

Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS SPACE AND SHAPE

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Hong Kong-China	558	(4.8)	549	568
Japan	553	(4.3)	545	562
Korea	552	(3.8)	544	559
Switzerland	540	(3.5)	533	546
Finland	539	(2.0)	535	543
Liechtenstein	538	(4.6)	529	547
Alberta	534	(4.3)	526	543
Belgium	530	(2.3)	525	534
Macao-China	528	(3.3)	521	534
Quebec	528	(4.5)	519	537
Czech Republic	527	(4.1)	519	535
Netherlands	526	(2.9)	521	532
New Zealand	525	(2.3)	520	530
British Columbia	523	(2.6)	517	528
Australia	521	(2.3)	516	525
Canada	**518**	**(1.8)**	**514**	**521**
Austria	515	(3.5)	508	522
Manitoba	513	(3.5)	506	519
Denmark	512	(2.8)	507	518
Ontario	512	(3.6)	505	519
France	508	(3.0)	502	513
Slovak Republic	505	(4.0)	498	513
Iceland	504	(1.5)	501	506
Saskatchewan	500	(3.7)	493	507
Germany	500	(3.3)	493	506
Sweden	498	(2.6)	493	503
Newfoundland and Labrador	498	(2.7)	493	503
Nova Scotia	498	(2.4)	493	502
New Brunswick	498	(1.7)	494	501
Poland	490	(2.7)	485	496
Luxembourg	488	(1.4)	486	491
Latvia	486	(4.0)	478	494
Norway	483	(2.5)	478	488
Prince Edward Island	480	(2.5)	475	485
Hungary	479	(3.3)	473	486
Spain	476	(2.6)	471	482
Ireland	476	(2.4)	471	481
Russian Federation	474	(4.7)	465	484
United States	472	(2.8)	467	477
Italy	470	(3.1)	464	476
Portugal	450	(3.4)	444	457
Greece	437	(3.8)	430	445
Serbia and Montenegro (Ser.)	432	(3.9)	425	440
Thailand	424	(3.3)	417	430
Turkey	417	(6.3)	405	430
Uruguay	412	(3.0)	406	418
Mexico	382	(3.2)	375	388
Indonesia	361	(3.7)	354	368
Tunisia	359	(2.6)	354	364
Brazil	350	(4.1)	342	358

Note: The OECD average is 496 with a standard error of 0.7.

Table B1.3

Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS CHANGE AND RELATIONSHIPS

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Alberta	554	(4.4)	546	563
Netherlands	551	(3.1)	545	558
Korea	548	(3.5)	541	554
British Columbia	543	(2.5)	538	548
Finland	543	(2.2)	539	547
Hong Kong-China	540	(4.7)	531	549
Liechtenstein	540	(3.7)	532	547
Quebec	538	(5.0)	528	547
Canada	**537**	**(1.9)**	**533**	**540**
Japan	536	(4.3)	528	545
Ontario	536	(3.8)	528	543
Belgium	535	(2.4)	530	540
Manitoba	532	(3.2)	526	538
New Zealand	526	(2.4)	521	530
Australia	525	(2.3)	521	530
Switzerland	523	(3.7)	516	530
Newfoundland and Labrador	521	(2.6)	516	526
Saskatchewan	520	(4.1)	512	528
France	520	(2.6)	515	525
Macao-China	519	(3.5)	512	526
Nova Scotia	517	(2.2)	513	522
Czech Republic	515	(3.5)	508	522
New Brunswick	513	(1.9)	509	517
Iceland	509	(1.4)	507	512
Denmark	509	(3.0)	503	515
Germany	507	(3.7)	500	514
Ireland	506	(2.4)	501	511
Sweden	505	(2.9)	499	511
Prince Edward Island	502	(2.0)	498	506
Austria	500	(3.6)	493	507
Hungary	495	(3.1)	489	501
Slovak Republic	494	(3.5)	488	501
Norway	488	(2.6)	483	493
Latvia	487	(4.4)	479	496
Luxembourg	487	(1.2)	485	489
United States	486	(3.0)	480	491
Poland	484	(2.7)	479	490
Spain	481	(2.8)	475	486
Russian Federation	477	(4.6)	468	486
Portugal	468	(4.0)	460	476
Italy	452	(3.2)	446	458
Greece	436	(4.3)	427	444
Turkey	423	(7.6)	408	438
Serbia and Montenegro (Ser.)	419	(4.0)	411	427
Uruguay	417	(3.6)	410	424
Thailand	405	(3.4)	398	412
Mexico	364	(4.1)	356	372
Tunisia	337	(2.8)	331	342
Indonesia	334	(4.6)	325	343
Brazil	333	(6.0)	321	345

Note: The OECD average is 499 with a standard error of 0.7.

Table B1.4

Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS QUANTITY

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Finland	549	(1.8)	545	552
Hong Kong-China	545	(4.2)	537	553
Alberta	545	(4.0)	537	552
Korea	537	(3.0)	531	543
Liechtenstein	534	(4.1)	525	542
British Columbia	533	(2.3)	528	538
Macao-China	533	(3.0)	527	539
Switzerland	533	(3.1)	527	539
Quebec	531	(4.7)	522	541
Belgium	530	(2.3)	525	534
Netherlands	528	(3.1)	522	534
Canada	**528**	**(1.8)**	**524**	**532**
Czech Republic	528	(3.5)	521	535
Japan	527	(3.8)	519	534
Ontario	526	(3.8)	519	534
Manitoba	523	(3.2)	517	529
Australia	517	(2.1)	513	521
Denmark	516	(2.6)	510	521
Germany	514	(3.4)	507	520
Sweden	514	(2.5)	509	518
Iceland	513	(1.5)	510	516
Austria	513	(3.0)	507	519
Saskatchewan	513	(3.9)	505	520
Newfoundland and Labrador	512	(2.6)	507	517
Slovak Republic	513	(3.4)	506	519
New Zealand	511	(2.2)	507	515
Nova Scotia	511	(2.2)	506	515
France	507	(2.5)	502	512
New Brunswick	507	(2.1)	503	511
Ireland	502	(2.5)	497	507
Luxembourg	501	(1.1)	499	504
Hungary	496	(2.7)	491	502
Prince Edward Island	496	(2.2)	491	500
Norway	494	(2.2)	490	499
Spain	492	(2.5)	487	497
Poland	492	(2.5)	487	497
Latvia	482	(3.6)	475	489
United States	476	(3.2)	470	483
Italy	475	(3.4)	468	481
Russian Federation	472	(4.0)	465	480
Portugal	465	(3.5)	459	472
Serbia and Montenegro (Ser.)	456	(3.8)	449	464
Greece	446	(4.0)	438	454
Uruguay	430	(3.2)	423	436
Thailand	415	(3.1)	409	421
Turkey	413	(6.8)	400	426
Mexico	394	(3.9)	386	402
Tunisia	364	(2.8)	359	370
Brazil	360	(5.0)	350	370
Indonesia	357	(4.3)	349	366

Note: The OECD average is 501 with a standard error of 0.6.

Table B1.5

Estimated average scores and confidence intervals for provinces and countries: MATHEMATICS UNCERTAINTY

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Hong Kong-China	558	(4.6)	549	567
Alberta	556	(4.4)	547	565
British Columbia	550	(2.4)	545	555
Netherlands	549	(3.0)	543	555
Finland	545	(2.1)	541	549
Quebec	542	(4.8)	533	551
Canada	**542**	**(1.8)**	**538**	**545**
Ontario	540	(3.6)	533	547
Korea	538	(3.0)	532	544
Manitoba	538	(3.0)	532	544
New Zealand	532	(2.3)	528	537
Macao-China	532	(3.2)	525	538
Australia	531	(2.2)	527	535
Newfoundland and Labrador	530	(2.5)	525	535
Japan	528	(3.9)	520	535
Iceland	528	(1.5)	525	531
Nova Scotia	528	(2.2)	523	532
Saskatchewan	526	(4.0)	519	534
Belgium	526	(2.2)	521	530
Liechtenstein	523	(3.7)	516	531
New Brunswick	523	(1.8)	519	526
Ireland	517	(2.6)	512	522
Switzerland	517	(3.3)	510	523
Denmark	516	(2.8)	510	521
Prince Edward Island	515	(2.2)	510	519
Norway	513	(2.6)	508	518
Sweden	511	(2.7)	506	516
France	506	(2.4)	501	511
Czech Republic	500	(3.1)	494	506
Austria	494	(3.1)	488	500
Poland	494	(2.3)	489	498
Germany	493	(3.3)	486	499
Luxembourg	492	(1.1)	490	494
United States	491	(3.0)	486	497
Hungary	489	(2.6)	484	494
Spain	489	(2.4)	484	494
Slovak Republic	476	(3.2)	470	482
Latvia	474	(3.3)	467	480
Portugal	471	(3.4)	464	477
Italy	463	(3.0)	457	469
Greece	458	(3.5)	451	465
Turkey	443	(6.2)	430	455
Russian Federation	436	(4.0)	429	444
Serbia and Montenegro (Ser.)	428	(3.5)	421	435
Thailand	423	(2.5)	418	428
Uruguay	419	(3.1)	412	425
Mexico	390	(3.3)	383	396
Indonesia	385	(2.9)	379	390
Brazil	377	(3.9)	369	384
Tunisia	363	(2.3)	359	368

Note: The OECD average is 502 with a standard error of 0.6.

Table B1.6

Variation in combined mathematics performance, Canada and the provinces

	Variance	Standard error	Ratio
Canada	**7,588.12**	**(169.70)**	**1.00**
Newfoundland and Labrador	6,946.84	(295.04)	0.92
Prince Edward Island	7,379.07	(293.94)	0.97
Nova Scotia	7,069.40	(275.71)	0.93
New Brunswick	7,404.28	(196.55)	0.98
Quebec	8,670.44	(421.23)	1.14
Ontario	6,957.44	(313.30)	0.92
Manitoba	7,738.30	(360.13)	1.02
Saskatchewan	7,512.17	(386.47)	0.99
Alberta	7,576.65	(247.95)	1.00
British Columbia	7,181.90	(210.45)	0.95

Table B1.7

Percent of students at each level for provinces and countries COMBINED MATHEMATICS

Country and province	Below Level 1 %	(SE)	Level 1 %	(SE)	Level 2 %	(SE)	Level 3 %	(SE)	Level 4 %	(SE)	Level 5 %	(SE)	Level 6 %	(SE)
Finland	1.5	(0.2)	5.3	(0.4)	16.0	(0.6)	27.7	(0.7)	26.1	(0.9)	16.7	(0.6)	6.7	(0.5)
Alberta	1.7	(0.3)	5.7	(0.8)	15.0	(2.1)	24.6	(1.4)	26.0	(1.7)	18.5	(1.1)	8.5	(1.4)
British Columbia	1.7	(0.3)	6.9	(0.6)	17.6	(1.0)	25.8	(1.1)	26.3	(1.0)	15.8	(0.8)	5.9	(0.6)
Korea	2.5	(0.3)	7.1	(0.7)	16.6	(0.8)	24.1	(1.0)	25.0	(1.1)	16.7	(0.8)	8.1	(0.9)
Ontario	2.0	(0.4)	7.7	(0.8)	19.1	(1.1)	27.7	(1.3)	25.1	(1.3)	13.8	(1.2)	4.6	(0.8)
Canada	**2.4**	**(0.3)**	**7.7**	**(0.4)**	**18.3**	**(0.6)**	**26.2**	**(0.7)**	**25.1**	**(0.6)**	**14.8**	**(0.5)**	**5.5**	**(0.4)**
Hong Kong-China	3.9	(0.7)	6.5	(0.6)	13.9	(1.0)	20.0	(1.2)	25.0	(1.2)	20.2	(1.0)	10.5	(0.9)
Netherlands	2.6	(0.7)	8.4	(0.9)	18.0	(1.1)	23.0	(1.1)	22.6	(1.3)	18.2	(1.1)	7.3	(0.6)
Manitoba	2.8	(0.6)	8.2	(0.8)	19.2	(1.2)	26.3	(1.4)	24.5	(1.5)	14.2	(1.2)	4.8	(0.6)
Quebec	3.3	(0.6)	7.8	(0.9)	16.2	(1.3)	23.5	(1.5)	25.6	(1.5)	16.6	(1.2)	7.0	(0.8)
Macao-China	2.3	(0.6)	8.8	(1.3)	19.6	(1.4)	26.8	(1.8)	23.7	(1.7)	13.8	(1.6)	4.8	(1.0)
Liechtenstein	4.8	(1.3)	7.5	(1.7)	17.3	(2.8)	21.6	(2.5)	23.2	(3.1)	18.3	(3.2)	7.3	(1.7)
Newfoundland and Labrador	2.9	(0.6)	9.6	(0.9)	22.2	(1.6)	27.5	(1.5)	23.6	(1.4)	11.2	(1.1)	3.0	(0.5)
Japan	4.7	(0.7)	8.6	(0.7)	16.3	(0.8)	22.4	(1.0)	23.6	(1.2)	16.1	(1.0)	8.2	(1.1)
Nova Scotia	3.2	(0.5)	10.4	(0.7)	21.5	(1.1)	28.3	(1.1)	22.3	(1.4)	11.3	(1.1)	3.0	(0.6)
Saskatchewan	3.9	(1.0)	9.9	(0.9)	20.9	(1.5)	26.7	(1.5)	23.7	(1.5)	11.7	(1.1)	3.2	(0.5)
New Brunswick	3.7	(0.5)	10.6	(0.6)	22.8	(0.9)	27.4	(1.0)	22.0	(1.0)	10.1	(0.8)	3.4	(0.4)
Australia	4.3	(0.4)	10.0	(0.5)	18.6	(0.6)	24.0	(0.7)	23.3	(0.6)	14.0	(0.5)	5.8	(0.4)
Switzerland	4.9	(0.4)	9.6	(0.6)	17.5	(0.8)	24.3	(1.0)	22.5	(0.7)	14.2	(1.1)	7.0	(0.9)
Iceland	4.5	(0.4)	10.5	(0.6)	20.2	(1.0)	26.1	(0.9)	23.2	(0.8)	11.7	(0.6)	3.7	(0.4)
New Zealand	4.9	(0.4)	10.1	(0.6)	19.2	(0.7)	23.2	(0.9)	21.9	(0.8)	14.1	(0.6)	6.6	(0.4)
Denmark	4.7	(0.5)	10.7	(0.6)	20.6	(0.9)	26.2	(0.9)	21.9	(0.8)	11.8	(0.9)	4.1	(0.5)
Belgium	7.2	(0.6)	9.3	(0.5)	15.9	(0.6)	20.1	(0.7)	21.0	(0.6)	17.5	(0.7)	9.0	(0.5)
Czech Republic	5.0	(0.7)	11.6	(0.9)	20.1	(1.0)	24.3	(0.9)	20.8	(0.9)	12.9	(0.8)	5.3	(0.5)
France	5.6	(0.7)	11.0	(0.8)	20.2	(0.8)	25.9	(1.0)	22.1	(1.0)	11.6	(0.7)	3.5	(0.4)
Ireland	4.7	(0.6)	12.1	(0.8)	23.6	(0.8)	28.0	(0.8)	20.2	(1.1)	9.1	(0.8)	2.2	(0.3)
Sweden	5.6	(0.5)	11.7	(0.6)	21.7	(0.8)	25.5	(0.9)	19.8	(0.8)	11.6	(0.6)	4.1	(0.5)
Prince Edward Island	5.2	(0.5)	12.5	(1.0)	23.7	(1.6)	28.0	(1.8)	20.5	(1.2)	7.5	(0.8)	2.6	(0.7)
Austria	5.6	(0.7)	13.2	(0.8)	21.6	(0.9)	24.9	(1.1)	20.5	(0.8)	10.5	(0.9)	3.7	(0.5)
Slovak Republic	6.7	(0.8)	13.2	(0.9)	23.5	(0.9)	24.9	(1.1)	18.9	(0.8)	9.8	(0.7)	2.9	(0.4)
Norway	6.9	(0.5)	13.9	(0.8)	23.7	(1.2)	25.2	(1.0)	18.9	(1.0)	8.7	(0.6)	2.7	(0.3)
OECD average	8.2	(0.2)	13.2	(0.2)	21.1	(0.1)	23.7	(0.2)	19.1	(0.2)	10.6	(0.1)	4.0	(0.1)
Germany	9.2	(0.8)	12.4	(0.8)	19.0	(1.0)	22.6	(0.8)	20.6	(1.0)	12.2	(0.9)	4.1	(0.5)
Luxembourg	7.4	(0.4)	14.3	(0.6)	22.9	(0.9)	25.9	(0.8)	18.7	(0.8)	8.5	(0.6)	2.4	(0.3)
Poland	6.8	(0.6)	15.2	(0.8)	24.8	(0.7)	25.3	(0.9)	17.7	(0.9)	7.8	(0.5)	2.3	(0.3)
Spain	8.1	(0.7)	14.9	(0.9)	24.7	(0.8)	26.7	(1.0)	17.7	(0.6)	6.5	(0.6)	1.4	(0.2)
Hungary	7.8	(0.8)	15.2	(0.8)	23.8	(1.0)	24.3	(0.9)	18.2	(0.9)	8.2	(0.7)	2.5	(0.4)
Latvia	7.6	(0.9)	16.1	(1.1)	25.5	(1.2)	26.3	(1.2)	16.6	(1.2)	6.3	(0.7)	1.6	(0.4)
United States	10.2	(0.8)	15.5	(0.8)	23.9	(0.8)	23.8	(0.8)	16.6	(0.7)	8.0	(0.5)	2.0	(0.4)
Portugal	11.3	(1.1)	18.8	(1.0)	27.1	(1.0)	24.0	(1.0)	13.4	(0.9)	4.6	(0.5)	0.8	(0.2)
Russian Federation	11.4	(1.0)	18.8	(1.1)	26.4	(1.1)	23.1	(1.0)	13.2	(0.9)	5.4	(0.6)	1.6	(0.4)
Italy	13.2	(1.2)	18.7	(0.9)	24.7	(1.0)	22.9	(0.8)	13.4	(0.7)	5.5	(0.4)	1.5	(0.2)
Greece	17.8	(1.2)	21.2	(1.2)	26.3	(1.0)	20.2	(1.0)	10.6	(0.9)	3.4	(0.5)	0.6	(0.2)
Serbia and Montenegro (Ser.)	17.6	(1.3)	24.5	(1.1)	28.6	(1.2)	18.9	(1.1)	8.1	(0.9)	2.1	(0.4)	0.2	(0.1)
Uruguay	26.3	(1.3)	21.8	(0.8)	24.2	(0.9)	16.8	(0.7)	8.2	(0.7)	2.3	(0.3)	0.5	(0.2)
Turkey	27.7	(2.0)	24.6	(1.3)	22.1	(1.1)	13.5	(1.3)	6.8	(1.0)	3.1	(0.8)	2.4	(1.0)
Thailand	23.8	(1.3)	30.2	(1.2)	25.4	(1.1)	13.7	(0.8)	5.3	(0.5)	1.5	(0.3)	0.2	(0.1)
Mexico	38.1	(1.7)	27.9	(1.0)	20.8	(0.9)	10.1	(0.8)	2.7	(0.4)	0.4	(0.1)	0.0	(0.0)
Brazil	53.3	(1.9)	21.9	(1.1)	14.1	(0.9)	6.8	(0.8)	2.7	(0.5)	0.9	(0.4)	0.3	(0.2)
Tunisia	51.1	(1.4)	26.9	(1.0)	14.7	(0.8)	5.7	(0.6)	1.4	(0.3)	0.2	(0.1)	0.0	
Indonesia	50.5	(2.1)	27.6	(1.1)	14.8	(1.1)	5.5	(0.7)	1.4	(0.4)	0.2	(0.1)	0.0	

Note: Countries and provinces have been sorted by the total percentage of students who attained level 2 or higher.

Table B1.8

Gender differences by country and province: COMBINED MATHEMATICS

Country and province	Females: Estimated average score	Females: Standard error	Males: Estimated average score	Males: Standard error	Difference (M - F)[1]: Score difference	Difference (M - F)[1]: Standard error
Liechtenstein	521	(6.3)	550	(7.2)	**29**	(10.9)
Korea	528	(5.3)	552	(4.4)	**23**	(6.8)
Macao-China	517	(3.3)	538	(4.8)	**21**	(5.8)
Greece	436	(3.8)	455	(4.8)	**19**	(3.6)
Slovak Republic	489	(3.6)	507	(3.9)	**19**	(3.7)
Italy	457	(3.8)	475	(4.6)	**18**	(5.9)
Luxembourg	485	(1.5)	502	(1.9)	**17**	(2.8)
Switzerland	518	(3.6)	535	(4.7)	**17**	(4.9)
Denmark	506	(3.0)	523	(3.4)	**17**	(3.2)
Brazil	348	(4.4)	365	(6.1)	**16**	(4.1)
Turkey	415	(6.7)	430	(7.9)	**15**	(6.2)
Czech Republic	509	(4.4)	524	(4.3)	**15**	(5.1)
Ireland	495	(3.4)	510	(3.0)	**15**	(4.2)
New Zealand	516	(3.2)	531	(2.8)	**14**	(3.9)
Manitoba	521	(3.9)	535	(4.1)	**14**	(5.0)
Portugal	460	(3.4)	472	(4.2)	**12**	(3.3)
Tunisia	353	(2.9)	365	(2.7)	**12**	(2.5)
Uruguay	416	(3.8)	428	(4.0)	**12**	(4.2)
OECD average	494	(0.8)	506	(0.8)	11	(0.8)
Nova Scotia	509	(2.9)	521	(3.0)	**11**	(3.9)
Canada	530	(1.9)	541	(2.1)	**11**	(2.1)
Ontario	524	(3.6)	536	(4.6)	**11**	(4.0)
Mexico	380	(4.1)	391	(4.3)	**11**	(3.9)
Newfoundland and Labrador	512	(3.0)	522	(3.5)	**10**	(4.2)
Russian Federation	463	(4.2)	473	(5.3)	**10**	(4.4)
Alberta	544	(4.2)	554	(5.3)	**10**	(4.4)
Germany	499	(3.9)	508	(4.0)	**9**	(4.4)
Spain	481	(2.2)	490	(3.4)	**9**	(3.0)
France	507	(2.9)	515	(3.6)	**9**	(4.2)
Japan	530	(4.0)	539	(5.8)	8	(5.9)
British Columbia	534	(2.2)	542	(3.4)	**8**	(3.2)
Hungary	486	(3.3)	494	(3.3)	**8**	(3.5)
Austria	502	(4.0)	509	(4.0)	8	(4.4)
Belgium	525	(3.2)	533	(3.4)	8	(4.8)
Finland	541	(2.1)	548	(2.5)	**7**	(2.7)
Quebec	534	(4.7)	541	(5.7)	7	(4.6)
Sweden	506	(3.1)	512	(3.0)	**7**	(3.3)
United States	480	(3.2)	486	(3.3)	**6**	(2.9)
Norway	492	(2.9)	498	(2.8)	6	(3.2)
New Brunswick	509	(1.9)	515	(2.7)	**6**	(2.9)
Poland	487	(2.9)	493	(3.0)	6	(3.1)
Australia	522	(2.7)	527	(3.0)	5	(3.8)
Netherlands	535	(3.5)	540	(4.1)	5	(4.3)
Hong Kong-China	548	(4.6)	552	(6.5)	4	(6.6)
Indonesia	358	(4.6)	362	(3.9)	3	(3.4)
Latvia	482	(3.6)	485	(4.8)	3	(4.0)
Serbia and Montenegro (Ser.)	436	(4.5)	437	(4.2)	1	(4.4)
Prince Edward Island	501	(2.7)	500	(3.3)	-1	(4.5)
Saskatchewan	518	(4.2)	515	(4.4)	-3	(3.7)
Thailand	419	(3.4)	415	(4.0)	-4	(4.2)
Iceland	523	(2.2)	508	(2.3)	**-15**	(3.5)

1. Significant differences are marked in bold. Difference is significant when the score difference +/-(1.96*SE) does not include zero.

Table B1.9

Gender differences by country and province: MATHEMATICS SPACE AND SHAPE

Country and province	Gender differences: Females – Estimated average score	Females – Standard error	Males – Estimated average score	Males – Standard error	Difference (M - F)[1] – Score difference	Difference (M - F)[1] – Standard error
Liechtenstein	518	(7.1)	557	(7.9)	**39**	(12.1)
Slovak Republic	487	(4.1)	522	(4.7)	**35**	(4.5)
Czech Republic	512	(5.1)	542	(4.8)	**30**	(5.7)
Luxembourg	474	(2.0)	503	(2.2)	**28**	(3.3)
Korea	536	(6.2)	563	(5.1)	**27**	(8.0)
Ireland	463	(3.4)	489	(3.0)	**25**	(4.3)
Switzerland	526	(3.7)	552	(5.3)	**25**	(5.6)
Macao-China	517	(4.3)	540	(5.1)	**23**	(6.8)
Manitoba	501	(4.6)	524	(4.3)	**23**	(5.7)
Uruguay	402	(3.4)	423	(3.6)	**21**	(3.6)
Russian Federation	464	(5.0)	485	(5.8)	**21**	(5.0)
Ontario	503	(4.2)	523	(4.4)	**20**	(4.6)
Canada	511	(2.2)	530	(2.1)	**20**	(2.5)
Greece	428	(3.8)	447	(4.7)	**19**	(4.0)
Austria	506	(4.3)	525	(4.4)	**19**	(5.2)
Spain	467	(2.4)	486	(3.5)	**18**	(3.0)
Italy	462	(4.1)	480	(4.7)	**18**	(6.3)
Alberta	525	(4.2)	543	(5.5)	**18**	(5.0)
New Zealand	516	(3.3)	534	(2.7)	**18**	(3.9)
Belgium	520	(3.3)	538	(3.2)	**18**	(4.6)
France	499	(3.2)	517	(4.3)	**18**	(4.7)
OECD average	488	(0.8)	505	(0.8)	17	(0.9)
British Columbia	513	(2.7)	531	(3.5)	**17**	(3.7)
Nova Scotia	489	(3.2)	506	(3.0)	**16**	(4.1)
Denmark	504	(3.3)	521	(3.4)	**16**	(3.7)
Tunisia	351	(3.2)	367	(2.8)	**16**	(3.0)
Indonesia	353	(4.2)	369	(3.7)	**16**	(2.9)
Mexico	374	(3.5)	390	(4.1)	**16**	(3.8)
United States	464	(3.1)	480	(3.3)	**15**	(3.2)
Newfoundland and Labrador	491	(3.4)	506	(3.9)	**15**	(4.9)
Portugal	443	(3.5)	458	(4.2)	**15**	(3.5)
Hungary	471	(3.9)	486	(3.8)	**15**	(4.0)
Brazil	343	(4.0)	358	(5.2)	**15**	(4.1)
New Brunswick	490	(2.2)	505	(2.7)	**15**	(3.4)
Latvia	480	(3.9)	494	(5.2)	**14**	(4.2)
Quebec	522	(4.5)	535	(5.6)	**14**	(4.9)
Poland	484	(3.3)	497	(3.2)	**13**	(3.7)
Australia	515	(2.9)	526	(3.2)	**12**	(3.9)
Turkey	411	(6.2)	423	(7.6)	**12**	(6.0)
Germany	494	(4.0)	506	(4.0)	**11**	(4.7)
Sweden	493	(3.2)	503	(3.0)	**10**	(3.5)
Japan	549	(4.2)	558	(6.3)	9	(6.3)
Prince Edward Island	476	(3.7)	485	(4.0)	9	(5.8)
Netherlands	522	(3.4)	530	(3.7)	8	(4.3)
Norway	479	(3.5)	486	(3.1)	7	(4.3)
Saskatchewan	497	(4.4)	503	(4.1)	6	(4.3)
Thailand	422	(3.8)	426	(4.3)	5	(4.7)
Hong Kong-China	556	(5.0)	560	(6.8)	4	(6.8)
Serbia and Montenegro (Ser.)	431	(4.9)	434	(4.3)	3	(4.9)
Finland	538	(2.4)	540	(2.6)	2	(3.0)
Iceland	511	(2.3)	496	(2.4)	**-15**	(3.7)

1. Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B1.10

Gender differences by country and province: MATHEMATICS CHANGE AND RELATIONSHIPS

	Gender differences					
	Females		Males		Difference (M - F)[1]	
Country and province	Estimated average score	Standard error	Estimated average score	Standard error	Score difference	Standard error
Liechtenstein	526	(6.5)	552	(7.4)	**26**	(12.1)
Korea	532	(5.8)	558	(4.7)	**25**	(7.3)
Italy	442	(4.0)	463	(4.9)	**21**	(6.3)
Denmark	499	(3.3)	520	(3.7)	**21**	(3.5)
Macao-China	509	(4.6)	529	(5.0)	**20**	(6.6)
Brazil	324	(5.5)	344	(7.3)	**20**	(4.7)
Greece	427	(4.4)	445	(5.2)	**18**	(4.2)
New Zealand	517	(3.4)	534	(2.8)	**17**	(4.1)
Slovak Republic	486	(3.9)	502	(4.1)	**16**	(4.2)
Manitoba	524	(3.9)	540	(4.4)	**16**	(5.3)
Switzerland	515	(3.9)	530	(5.1)	**15**	(5.3)
Ontario	529	(3.8)	544	(4.9)	**15**	(4.0)
Luxembourg	480	(1.8)	494	(2.5)	**14**	(3.7)
Canada	532	(2.0)	546	(2.2)	**13**	(2.3)
Portugal	462	(4.0)	475	(4.8)	**13**	(3.8)
Czech Republic	508	(4.0)	521	(4.5)	**13**	(4.9)
Ireland	500	(3.5)	512	(3.0)	**13**	(4.4)
Nova Scotia	511	(3.1)	524	(3.1)	**13**	(4.3)
Germany	502	(4.4)	514	(4.3)	**12**	(4.4)
OECD average	493	(0.8)	504	(0.8)	11	(0.9)
Finland	537	(2.4)	549	(2.8)	**11**	(2.8)
Tunisia	331	(3.3)	342	(3.0)	**11**	(3.0)
Alberta	549	(4.9)	560	(5.3)	**11**	(5.3)
Newfoundland and Labrador	516	(3.2)	526	(3.7)	**10**	(4.5)
British Columbia	538	(2.4)	548	(3.6)	**10**	(3.7)
Hungary	490	(3.6)	499	(3.6)	**10**	(3.9)
Spain	477	(2.6)	485	(3.8)	**8**	(3.3)
Quebec	534	(4.9)	542	(6.0)	8	(4.7)
New Brunswick	509	(2.0)	517	(2.8)	**8**	(3.0)
Mexico	360	(4.6)	368	(4.9)	8	(4.4)
Poland	481	(3.4)	488	(3.1)	**8**	(3.6)
Belgium	531	(3.5)	539	(3.6)	8	(5.1)
Japan	533	(4.3)	539	(6.4)	6	(6.6)
Turkey	419	(7.4)	425	(9.1)	6	(7.2)
Netherlands	548	(3.7)	554	(3.8)	6	(4.3)
United States	483	(3.3)	488	(3.4)	6	(2.9)
Uruguay	414	(4.2)	420	(4.2)	5	(4.4)
Austria	497	(4.4)	502	(4.4)	5	(5.0)
Australia	523	(2.8)	527	(3.2)	4	(3.8)
France	518	(3.2)	522	(4.0)	4	(5.0)
Norway	486	(3.1)	490	(3.2)	4	(3.3)
Indonesia	332	(5.4)	336	(4.4)	4	(3.4)
Russian Federation	475	(4.5)	479	(6.0)	3	(5.1)
Serbia and Montenegro (Ser.)	418	(4.9)	420	(4.5)	1	(4.9)
Sweden	504	(3.9)	506	(3.4)	1	(4.3)
Hong Kong-China	539	(4.8)	540	(6.8)	1	(7.2)
Prince Edward Island	502	(2.7)	501	(3.7)	-1	(5.0)
Latvia	488	(4.3)	487	(5.3)	-1	(4.0)
Saskatchewan	521	(4.4)	519	(4.7)	-2	(3.9)
Iceland	514	(2.3)	505	(2.4)	**-10**	(3.8)
Thailand	409	(4.0)	400	(4.5)	-10	(5.1)

1. Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B1.11

Gender differences by country and province: MATHEMATICS QUANTITY

Country and province	Gender differences					
	Females		Males		Difference (M - F)[1]	
	Estimated average score	Standard error	Estimated average score	Standard error	Score difference	Standard error
Greece	435	(4.0)	458	(4.9)	**23**	(4.0)
Korea	524	(4.9)	546	(4.0)	**22**	(6.2)
Liechtenstein	523	(5.6)	544	(7.0)	**21**	(9.9)
Brazil	351	(4.8)	370	(6.3)	**18**	(4.5)
Turkey	404	(6.6)	421	(8.0)	**18**	(6.3)
Macao-China	525	(4.2)	542	(4.3)	**17**	(6.0)
Tunisia	357	(3.3)	372	(2.9)	**16**	(2.7)
Portugal	459	(3.7)	473	(4.1)	**14**	(3.3)
Italy	469	(4.4)	481	(5.0)	13	(6.5)
Slovak Republic	506	(3.6)	519	(4.0)	**13**	(3.6)
Mexico	388	(4.3)	400	(4.8)	**12**	(4.5)
Uruguay	424	(3.8)	436	(3.9)	**12**	(4.1)
New Zealand	505	(3.2)	517	(2.7)	**12**	(3.9)
Denmark	511	(2.9)	520	(3.2)	**9**	(3.1)
Ireland	497	(3.5)	506	(3.1)	**9**	(4.3)
Luxembourg	497	(1.6)	506	(2.2)	**9**	(3.2)
Manitoba	519	(4.2)	527	(4.2)	8	(5.3)
Ontario	523	(3.8)	530	(4.8)	7	(4.2)
Switzerland	529	(3.2)	536	(4.4)	7	(4.6)
OECD average	498	(0.8)	504	(0.8)	6	(0.8)
Russian Federation	469	(4.2)	476	(5.0)	6	(4.4)
Czech Republic	525	(4.5)	531	(4.2)	6	(5.1)
Spain	490	(2.2)	495	(3.6)	5	(3.1)
Canada	528	(1.9)	533	(2.2)	**5**	(2.2)
Alberta	542	(3.8)	547	(5.5)	5	(5.1)
United States	474	(3.6)	478	(3.6)	4	(3.4)
Sweden	512	(3.2)	515	(2.9)	3	(3.6)
Finland	547	(2.1)	550	(2.3)	3	(2.3)
Japan	525	(3.7)	528	(5.6)	3	(5.7)
Austria	512	(3.7)	515	(3.7)	3	(4.2)
Latvia	480	(3.6)	483	(4.4)	3	(3.4)
Newfoundland and Labrador	511	(3.2)	514	(3.9)	3	(4.8)
France	506	(2.9)	508	(3.8)	2	(4.4)
Indonesia	356	(5.0)	359	(4.0)	2	(3.1)
Hungary	495	(3.2)	497	(3.3)	2	(3.6)
Poland	491	(3.0)	493	(2.9)	2	(3.3)
Nova Scotia	510	(3.2)	511	(3.1)	1	(4.4)
Australia	516	(2.7)	518	(2.9)	1	(3.7)
Belgium	529	(3.3)	530	(3.3)	1	(4.7)
Germany	514	(3.8)	515	(4.2)	1	(4.4)
Quebec	531	(4.6)	532	(5.7)	1	(4.5)
Norway	494	(2.7)	494	(2.8)	0	(3.3)
British Columbia	533	(2.6)	533	(3.2)	0	(3.6)
New Brunswick	508	(2.2)	506	(3.0)	-2	(3.1)
Hong Kong-China	546	(4.1)	544	(6.0)	-3	(6.1)
Serbia and Montenegro (Ser.)	458	(4.7)	455	(4.2)	-3	(4.7)
Netherlands	530	(3.6)	526	(4.2)	-4	(4.7)
Thailand	417	(3.8)	412	(4.1)	-5	(4.9)
Saskatchewan	517	(4.2)	509	(4.6)	-8	(4.3)
Prince Edward Island	500	(2.9)	491	(3.7)	-9	(4.9)
Iceland	528	(2.3)	500	(2.5)	**-28**	(3.9)

1. Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B1.12

Gender differences by country and province: MATHEMATICS UNCERTAINTY

Countries and provinces	Gender differences					
	Females		Males		Difference (M - F)[1]	
	Estimated average score	Standard error	Estimated average score	Standard error	Score difference	Standard error
Liechtenstein	508	(5.6)	538	(6.9)	**31**	(10.5)
Italy	451	(3.8)	475	(4.5)	**24**	(5.9)
Korea	525	(5.2)	547	(4.1)	**22**	(6.6)
Luxembourg	481	(1.8)	503	(2.2)	**22**	(3.5)
Denmark	505	(3.0)	527	(3.4)	**22**	(3.2)
Switzerland	506	(3.7)	526	(4.7)	**20**	(5.2)
Greece	449	(3.7)	469	(4.3)	**20**	(3.7)
Turkey	432	(6.1)	451	(7.3)	**19**	(5.7)
Germany	484	(3.8)	502	(3.9)	**18**	(4.0)
Macao-China	523	(4.2)	541	(4.5)	**18**	(5.9)
Slovak Republic	467	(3.4)	484	(3.8)	**17**	(3.5)
Czech Republic	492	(3.8)	509	(3.9)	**17**	(4.6)
Ireland	509	(3.7)	525	(3.2)	**15**	(4.6)
Manitoba	531	(3.7)	546	(3.8)	**15**	(4.5)
Brazil	369	(3.7)	385	(4.9)	**15**	(3.4)
Japan	521	(3.8)	535	(5.6)	**14**	(5.7)
OECD average	496	(0.8)	508	(0.7)	13	(0.8)
Ontario	534	(3.5)	547	(4.8)	**13**	(4.3)
Alberta	549	(4.3)	563	(5.5)	**13**	(4.7)
Canada	538	(1.9)	551	(2.2)	**13**	(2.3)
Finland	539	(2.3)	551	(2.6)	**12**	(2.6)
Hong Kong-China	552	(4.6)	564	(6.6)	12	(6.7)
New Zealand	526	(3.3)	538	(2.7)	**12**	(3.9)
Nova Scotia	522	(2.9)	533	(3.0)	**11**	(4.0)
France	501	(2.8)	512	(3.5)	**11**	(4.2)
Norway	508	(3.2)	518	(3.0)	**10**	(3.3)
Newfoundland and Labrador	525	(3.0)	535	(3.5)	**10**	(4.3)
Portugal	466	(3.5)	476	(4.1)	**10**	(3.1)
Netherlands	544	(3.7)	554	(3.6)	**9**	(4.1)
British Columbia	545	(2.3)	554	(3.5)	**9**	(3.5)
Quebec	538	(4.6)	547	(5.9)	**9**	(4.4)
Sweden	506	(3.4)	515	(3.2)	**9**	(3.7)
Russian Federation	432	(3.9)	441	(5.1)	**8**	(4.2)
Uruguay	415	(3.6)	423	(3.9)	**8**	(4.1)
Spain	485	(2.2)	493	(3.3)	**8**	(2.8)
Hungary	485	(3.0)	493	(3.2)	**8**	(3.3)
Austria	490	(4.0)	498	(3.8)	8	(4.6)
Belgium	522	(3.2)	529	(3.2)	7	(4.7)
Australia	527	(2.7)	535	(3.0)	**7**	(3.7)
New Brunswick	520	(1.9)	527	(2.6)	**7**	(2.8)
Tunisia	360	(2.8)	367	(2.5)	**7**	(2.6)
Serbia and Montenegro (Ser.)	425	(4.2)	431	(4.0)	5	(4.2)
Mexico	388	(3.6)	392	(3.8)	4	(3.5)
United States	490	(3.1)	493	(3.4)	3	(2.8)
Poland	492	(2.8)	495	(2.8)	3	(3.2)
Latvia	474	(3.1)	474	(4.2)	0	(3.3)
Prince Edward Island	515	(2.7)	514	(3.6)	-1	(4.6)
Saskatchewan	527	(4.3)	526	(4.6)	-2	(3.7)
Indonesia	387	(3.4)	382	(2.8)	**-5**	(2.4)
Thailand	425	(3.0)	420	(3.4)	-5	(4.0)
Iceland	532	(2.4)	524	(2.4)	**-8**	(3.8)

1. Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B2.1

Estimated average scores and confidence intervals for provinces and countries: READING

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Finland	543	(1.6)	540	547
Alberta	543	(4.3)	535	552
British Columbia	535	(2.5)	531	540
Korea	534	(3.1)	528	540
Ontario	530	(3.5)	523	536
Canada	**528**	**(1.7)**	**524**	**531**
Quebec	525	(4.3)	517	534
Australia	525	(2.1)	521	530
Liechtenstein	525	(3.6)	518	532
New Zealand	522	(2.5)	517	526
Newfoundland and Labrador	521	(3.2)	515	527
Manitoba	520	(3.3)	514	527
Ireland	515	(2.6)	510	521
Sweden	514	(2.4)	510	519
Nova Scotia	513	(2.3)	508	517
Netherlands	513	(2.9)	508	519
Saskatchewan	512	(4.2)	504	520
Hong Kong-China	510	(3.7)	502	517
Belgium	507	(2.6)	502	512
New Brunswick	503	(2.1)	499	507
Norway	500	(2.8)	494	505
Switzerland	499	(3.3)	493	506
Japan	498	(3.9)	490	506
Macao-China	498	(2.2)	493	502
Poland	497	(2.9)	491	502
France	496	(2.7)	491	501
United States	495	(3.2)	489	501
Prince Edward Island	495	(2.3)	490	499
Denmark	492	(2.8)	487	498
Iceland	492	(1.6)	489	495
Germany	491	(3.4)	485	498
Austria	491	(3.8)	483	498
Latvia	491	(3.7)	483	498
Czech Republic	489	(3.5)	482	495
Hungary	482	(2.5)	477	487
Spain	481	(2.6)	475	486
Luxembourg	479	(1.5)	477	482
Portugal	478	(3.7)	470	485
Italy	476	(3.0)	470	482
Greece	472	(4.1)	464	480
Slovak Republic	469	(3.1)	463	475
Russian Federation	442	(3.9)	434	450
Turkey	441	(5.8)	430	452
Uruguay	434	(3.4)	427	441
Thailand	420	(2.8)	414	425
Serbia and Montenegro (Ser.)	412	(3.6)	405	419
Brazil	403	(4.6)	394	412
Mexico	400	(4.1)	392	408
Indonesia	382	(3.4)	375	388
Tunisia	375	(2.8)	369	380

Note: The reading results for 2003 are based on the reading literacy proficiency scale that was developed for PISA 2000 which had a mean of 500 for the 27 OECD countries that participated in PISA 2000. However, because three additional OECD countries are included in the PISA 2003 reading test, the overall OECD average for PISA 2003 is 494 with a standard error of 0.6.

Table B2.2

Estimated average scores and confidence intervals for provinces and countries: SCIENCE

Country and province	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Finland	548	(1.9)	544	552
Japan	548	(4.1)	540	556
Hong Kong-China	539	(4.3)	531	548
Alberta	539	(5.6)	528	550
Korea	538	(3.5)	531	545
British Columbia	527	(2.8)	521	532
Liechtenstein	525	(4.3)	517	534
Australia	525	(2.1)	521	529
Macao-China	525	(3.0)	519	531
Netherlands	524	(3.1)	518	531
Czech Republic	523	(3.4)	517	530
New Zealand	521	(2.4)	516	526
Quebec	520	(5.2)	510	530
Canada	**519**	**(2.0)**	**515**	**523**
Ontario	515	(3.9)	508	523
Newfoundland and Labrador	514	(2.9)	508	519
Switzerland	513	(3.7)	506	520
Manitoba	512	(3.7)	505	519
France	511	(3.0)	505	517
Belgium	509	(2.5)	504	514
Sweden	506	(2.7)	501	511
Saskatchewan	506	(4.6)	497	515
Nova Scotia	505	(2.4)	501	510
Ireland	505	(2.7)	500	511
Hungary	503	(2.8)	498	509
Germany	502	(3.6)	495	509
Poland	498	(2.9)	492	503
New Brunswick	498	(2.2)	494	502
Slovak Republic	495	(3.7)	488	502
Iceland	495	(1.5)	492	498
United States	491	(3.1)	485	497
Austria	491	(3.4)	484	498
Russian Federation	489	(4.1)	481	497
Latvia	489	(3.9)	482	497
Prince Edward Island	489	(2.6)	484	494
Spain	487	(2.6)	482	492
Italy	486	(3.1)	480	493
Norway	484	(2.9)	479	490
Luxembourg	483	(1.5)	480	486
Greece	481	(3.8)	474	489
Denmark	475	(3.0)	469	481
Portugal	468	(3.5)	461	475
Uruguay	438	(2.9)	433	444
Serbia and Montenegro (Ser.)	436	(3.5)	430	443
Turkey	434	(5.9)	423	446
Thailand	429	(2.7)	424	434
Mexico	405	(3.5)	398	412
Indonesia	395	(3.2)	389	401
Brazil	390	(4.3)	381	398
Tunisia	385	(2.6)	380	390

Note: The OECD average is 500 with a standard error of 0.6.

Table B2.3

Estimated average scores and confidence intervals for provinces and countries: PROBLEM SOLVING

Country and provinces	Estimated average score	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Korea	550	(3.1)	544	556
Hong Kong-China	548	(4.2)	540	556
Finland	548	(1.9)	544	551
Japan	547	(4.1)	539	555
Alberta	546	(4.3)	538	555
British Columbia	536	(2.4)	532	541
New Zealand	533	(2.2)	529	537
Macao-China	532	(2.5)	527	537
Quebec	531	(4.3)	523	539
Australia	530	(2.0)	526	534
Liechtenstein	529	(3.9)	522	537
Canada	**529**	**(1.7)**	**526**	**533**
Ontario	527	(3.4)	520	533
Manitoba	527	(2.9)	521	533
Belgium	525	(2.2)	520	530
Switzerland	521	(3.0)	515	527
Netherlands	520	(3.0)	514	526
France	519	(2.7)	514	524
Newfoundland and Labrador	517	(3.2)	511	524
Denmark	517	(2.5)	512	522
Czech Republic	516	(3.4)	510	523
Saskatchewan	516	(4.0)	508	524
Nova Scotia	514	(2.3)	510	519
Germany	513	(3.2)	507	520
Sweden	509	(2.4)	504	513
New Brunswick	508	(2.2)	503	512
Austria	506	(3.2)	500	512
Iceland	505	(1.4)	502	507
Hungary	501	(2.9)	495	507
Prince Edward Island	498	(2.2)	493	502
Ireland	498	(2.3)	494	503
Luxembourg	494	(1.4)	491	496
Slovak Republic	492	(3.4)	485	498
Norway	490	(2.6)	485	495
Poland	487	(2.8)	481	492
Latvia	483	(3.9)	475	490
Spain	482	(2.7)	477	488
Russian Federation	479	(4.6)	470	488
United States	477	(3.1)	471	484
Portugal	470	(3.9)	462	477
Italy	470	(3.1)	463	476
Greece	449	(4.0)	441	456
Thailand	425	(2.7)	420	430
Serbia and Montenegro (Ser.)	420	(3.3)	414	427
Uruguay	411	(3.7)	403	418
Turkey	408	(6.0)	396	419
Mexico	384	(4.3)	376	393
Brazil	371	(4.8)	361	380
Indonesia	361	(3.3)	355	368
Tunisia	345	(2.1)	341	349

Note: The OECD average is 500 with a standard error of 0.6.

Table B2.4

Gender differences for provinces and countries: READING

	Gender differences					
	Females		Males		Difference (M - F)[1]	
Country and province	Estimated average score	Standard error	Estimated average score	Standard error	Score difference	Standard error
Macao-China	504	(2.8)	491	(3.6)	**-13**	(4.8)
Liechtenstein	534	(6.5)	517	(7.2)	-17	(11.9)
Netherlands	524	(3.2)	503	(3.7)	**-21**	(3.9)
Korea	547	(4.3)	525	(3.7)	**-21**	(5.6)
Mexico	410	(4.6)	389	(4.6)	**-21**	(4.4)
Japan	509	(4.1)	487	(5.5)	**-22**	(5.4)
Indonesia	394	(3.9)	369	(3.4)	**-24**	(2.8)
Ontario	542	(3.6)	517	(4.4)	**-25**	(4.1)
Tunisia	387	(3.3)	362	(3.3)	**-25**	(3.6)
Denmark	505	(3.0)	479	(3.3)	**-25**	(2.9)
New Zealand	535	(3.3)	508	(3.1)	**-28**	(4.4)
Russian Federation	456	(3.7)	428	(4.7)	**-29**	(3.9)
Ireland	530	(3.7)	501	(3.3)	**-29**	(4.6)
Manitoba	535	(3.7)	505	(4.7)	**-29**	(5.1)
Hungary	498	(3.0)	467	(3.2)	**-31**	(3.8)
Czech Republic	504	(4.4)	473	(4.1)	**-31**	(4.9)
Canada	546	(1.8)	514	(2.0)	**-32**	(2.0)
Hong Kong-China	525	(3.5)	494	(5.3)	**-32**	(5.5)
Nova Scotia	529	(3.3)	497	(3.1)	**-32**	(4.5)
British Columbia	551	(2.6)	519	(3.5)	**-32**	(3.7)
United States	511	(3.5)	479	(3.7)	**-32**	(3.3)
Slovak Republic	486	(3.3)	453	(3.8)	**-33**	(3.5)
Alberta	559	(4.4)	527	(5.3)	**-33**	(4.5)
Luxembourg	496	(1.8)	463	(2.6)	**-33**	(3.4)
Turkey	459	(6.1)	426	(6.8)	**-33**	(5.8)
OECD average	511	(0.7)	477	(0.7)	**-34**	**(0.8)**
Quebec	542	(4.2)	508	(5.5)	**-34**	(4.6)
Newfoundland and Labrador	538	(3.9)	503	(4.0)	**-34**	(4.9)
Brazil	419	(4.1)	384	(5.8)	**-35**	(3.9)
Switzerland	517	(3.1)	482	(4.4)	**-35**	(4.7)
Portugal	495	(3.7)	459	(4.3)	**-36**	(3.3)
Sweden	533	(2.9)	496	(2.8)	**-37**	(3.2)
Belgium	526	(3.3)	489	(3.8)	**-37**	(5.1)
Greece	490	(4.0)	453	(5.1)	**-37**	(4.1)
France	514	(3.2)	476	(3.8)	**-38**	(4.5)
Latvia	509	(3.7)	470	(4.5)	**-39**	(4.2)
Spain	500	(2.5)	461	(3.8)	**-39**	(3.9)
Uruguay	453	(3.7)	414	(4.5)	**-39**	(4.7)
Australia	545	(2.6)	506	(2.8)	**-39**	(3.6)
Italy	495	(3.4)	455	(5.1)	**-39**	(6.0)
Poland	516	(3.2)	477	(3.6)	**-40**	(3.7)
New Brunswick	523	(2.0)	483	(2.8)	**-40**	(3.0)
Germany	513	(3.9)	471	(4.2)	**-42**	(4.6)
Thailand	439	(3.0)	396	(3.7)	**-43**	(4.1)
Serbia and Montenegro (Ser.)	433	(3.9)	390	(3.7)	**-43**	(3.9)
Finland	565	(2.0)	521	(2.2)	**-44**	(2.7)
Saskatchewan	535	(4.3)	489	(4.7)	**-46**	(3.8)
Austria	514	(4.2)	467	(4.5)	**-47**	(5.2)
Prince Edward Island	517	(2.8)	469	(3.7)	**-48**	(4.8)
Norway	525	(3.4)	475	(3.4)	**-49**	(3.7)
Iceland	522	(2.2)	464	(2.3)	**-58**	(3.5)

1. Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B2.5

Gender differences for provinces and countries: SCIENCE

Country or province	Females: Estimated average score	Females: Standard error	Males: Estimated average score	Males: Standard error	Difference (M - F)[1]: Score difference	Difference (M - F)[1]: Standard error
Liechtenstein	512	(7.3)	538	(7.7)	**26**	(12.5)
Korea	527	(5.5)	546	(4.7)	**18**	(7.0)
Manitoba	504	(4.0)	521	(5.2)	**17**	(5.6)
Denmark	467	(3.2)	484	(3.6)	**17**	(3.2)
New Zealand	513	(3.4)	529	(3.0)	**16**	(4.2)
Slovak Republic	487	(3.9)	502	(4.3)	**15**	(3.7)
Luxembourg	477	(1.9)	489	(2.5)	**13**	(3.3)
Greece	475	(3.9)	487	(4.8)	**12**	(4.2)
Nova Scotia	500	(3.4)	511	(3.4)	**11**	(4.8)
Canada	516	(2.2)	527	(2.3)	**11**	(2.6)
Ontario	510	(4.1)	521	(5.1)	**11**	(4.8)
Switzerland	508	(3.9)	518	(5.0)	**10**	(5.0)
British Columbia	522	(3.2)	532	(4.0)	10	(4.7)
Mexico	400	(4.2)	410	(3.9)	**9**	(4.1)
Russian Federation	485	(4.0)	494	(5.3)	**9**	(4.3)
Newfoundland and Labrador	510	(3.6)	518	(4.3)	9	(5.5)
Macao-China	521	(4.0)	529	(5.0)	8	(6.8)
Alberta	535	(5.1)	543	(7.1)	8	(5.5)
Quebec	516	(5.2)	523	(6.3)	7	(4.9)
Poland	494	(3.4)	501	(3.2)	**7**	(3.3)
OECD average	497	(0.8)	503	(0.7)	6	(0.9)
Portugal	465	(3.6)	471	(4.0)	**6**	(3.2)
New Brunswick	495	(2.6)	501	(3.1)	6	(3.6)
Italy	484	(3.6)	490	(5.2)	6	(6.3)
Brazil	387	(4.3)	393	(5.3)	6	(3.9)
Germany	500	(4.2)	506	(4.5)	6	(4.8)
Czech Republic	520	(4.1)	526	(4.3)	6	(4.9)
Netherlands	522	(3.6)	527	(4.2)	5	(4.7)
United States	489	(3.5)	494	(3.5)	5	(3.3)
Sweden	504	(3.5)	509	(3.1)	5	(3.6)
Japan	546	(4.1)	550	(6.0)	4	(6.0)
Uruguay	436	(3.6)	441	(3.7)	4	(4.4)
Spain	485	(2.6)	489	(3.9)	4	(3.9)
Ireland	504	(3.9)	506	(3.1)	2	(4.5)
Norway	483	(3.3)	485	(3.5)	2	(3.6)
Indonesia	394	(3.8)	396	(3.1)	1	(2.7)
Turkey	434	(6.4)	434	(6.7)	0	(5.8)
Belgium	509	(3.5)	509	(3.6)	0	(5.0)
France	511	(3.5)	511	(4.1)	0	(4.8)
Australia	525	(2.8)	525	(2.9)	0	(3.8)
Hungary	504	(3.3)	503	(3.3)	-1	(3.7)
Prince Edward Island	489	(3.1)	488	(4.6)	-1	(5.7)
Austria	492	(4.2)	490	(4.3)	-3	(5.0)
Hong Kong-China	541	(4.2)	538	(6.1)	-3	(6.0)
Latvia	491	(3.9)	487	(5.1)	-4	(4.7)
Saskatchewan	508	(4.8)	503	(5.2)	-5	(4.1)
Serbia and Montenegro (Ser.)	439	(4.2)	434	(3.7)	-5	(3.8)
Finland	551	(2.2)	545	(2.6)	**-6**	(2.8)
Thailand	433	(3.1)	425	(3.7)	-8	(4.2)
Tunisia	390	(3.0)	380	(2.7)	**-10**	(2.6)
Iceland	500	(2.4)	490	(2.4)	**-10**	(3.8)

1 Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B2.6

Gender differences for provinces and countries: PROBLEM SOLVING

	Gender differences					
	Females		Males		Difference (M - F)[1]	
Country and province	Estimated average score	Standard error	Estimated average score	Standard error	Score difference	Standard error
Liechtenstein	524	(5.9)	535	(6.6)	12	(9.8)
Macao-China	527	(3.2)	538	(4.3)	**11**	(5.5)
Korea	546	(4.8)	554	(4.0)	8	(6.1)
Slovak Republic	488	(3.6)	495	(4.1)	7	(3.7)
Czech Republic	513	(4.3)	520	(4.1)	7	(5.0)
Brazil	368	(4.3)	374	(6.0)	5	(3.7)
Mexico	382	(4.7)	387	(5.0)	5	(4.5)
Denmark	514	(2.9)	519	(3.1)	5	(3.2)
Netherlands	518	(3.6)	522	(3.6)	4	(4.1)
Manitoba	525	(3.7)	529	(4.4)	3	(5.7)
Uruguay	409	(4.2)	412	(4.6)	3	(4.8)
Tunisia	343	(2.5)	346	(2.5)	3	(2.6)
Luxembourg	492	(1.9)	495	(2.4)	2	(3.3)
Russian Federation	477	(4.4)	480	(5.9)	2	(4.9)
Turkey	406	(5.8)	408	(7.3)	2	(5.8)
Greece	448	(4.1)	449	(4.9)	2	(4.4)
Alberta	546	(4.4)	547	(5.3)	1	(4.8)
Ontario	527	(3.4)	528	(4.3)	1	(3.9)
Ireland	498	(3.5)	499	(2.8)	1	(4.2)
Canada	532	(1.8)	533	(2.0)	0	(2.1)
Portugal	470	(3.9)	470	(4.6)	0	(3.5)
France	520	(2.9)	519	(3.8)	-1	(4.1)
United States	478	(3.5)	477	(3.4)	-1	(3.0)
Poland	487	(3.0)	486	(3.4)	-1	(3.1)
OECD average	501	(0.8)	499	(0.7)	**-2**	(0.8)
Newfoundland and Labrador	518	(3.9)	516	(4.2)	-2	(4.8)
British Columbia	537	(2.2)	535	(3.5)	-2	(3.5)
Nova Scotia	515	(3.3)	513	(3.0)	-2	(4.2)
Japan	548	(4.1)	546	(5.7)	-2	(5.7)
Switzerland	523	(3.3)	520	(4.0)	-2	(4.1)
Latvia	484	(4.0)	481	(5.1)	-3	(4.6)
Quebec	532	(4.2)	530	(5.4)	-3	(4.4)
Austria	508	(3.8)	505	(3.9)	-3	(4.3)
New Zealand	534	(3.1)	531	(2.6)	-3	(3.8)
Belgium	527	(3.2)	524	(3.1)	-3	(4.5)
Hungary	503	(3.4)	499	(3.4)	-4	(3.7)
Italy	471	(3.5)	467	(5.0)	-4	(6.0)
Hong Kong-China	550	(4.0)	545	(6.2)	-5	(6.3)
Germany	517	(3.7)	511	(3.9)	-6	(3.9)
Spain	485	(2.6)	479	(3.6)	-6	(3.1)
Australia	533	(2.5)	527	(2.7)	-6	(3.3)
New Brunswick	511	(2.1)	504	(3.3)	-6	(3.3)
Indonesia	365	(4.0)	358	(3.1)	**-7**	(3.0)
Serbia and Montenegro (Ser.)	424	(3.9)	416	(3.8)	-7	(4.1)
Norway	494	(3.2)	486	(3.1)	**-8**	(3.6)
Sweden	514	(2.8)	504	(3.0)	**-10**	(3.1)
Finland	553	(2.2)	543	(2.5)	**-10**	(3.0)
Thailand	431	(3.1)	418	(3.9)	**-12**	(4.3)
Prince Edward Island	503	(2.8)	491	(3.7)	**-13**	(4.8)
Saskatchewan	524	(4.4)	508	(4.6)	**-16**	(4.2)
Iceland	520	(2.5)	490	(2.2)	**-30**	(3.9)

1. Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

Table B3.1

Average score for indices of student engagement in mathematics, Canada and the provinces

	Index average	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Interest and enjoyment in mathematics				
Alberta	0.05	(0.02)	0.00	0.10
Newfoundland and Labrador	0.05	(0.03)	0.00	0.10
Quebec	0.02	(0.03)	-0.03	0.08
Nova Scotia	0.01	(0.02)	-0.04	0.06
New Brunswick	-0.01	(0.02)	-0.05	0.03
Canada	**-0.01**	**(0.01)**	**-0.04**	**0.02**
Ontario	-0.02	(0.04)	-0.09	0.05
Saskatchewan	-0.05	(0.03)	-0.11	0.01
Prince Edward Island	-0.09	(0.03)	-0.14	-0.03
Manitoba	-0.09	(0.03)	-0.14	-0.03
British Columbia	-0.12	(0.03)	-0.17	-0.07
Belief in the usefulness of mathematics				
Quebec	0.36	(0.03)	0.31	0.42
Nova Scotia	0.32	(0.03)	0.27	0.38
Newfoundland and Labrador	0.27	(0.02)	0.22	0.32
Alberta	0.27	(0.02)	0.23	0.31
Saskatchewan	0.24	(0.03)	0.18	0.29
Prince Edward Island	0.23	(0.03)	0.18	0.28
Canada	**0.23**	**(0.01)**	**0.20**	**0.26**
Manitoba	0.20	(0.02)	0.16	0.25
New Brunswick	0.15	(0.02)	0.12	0.19
Ontario	0.13	(0.03)	0.07	0.18
British Columbia	0.11	(0.02)	0.07	0.16
Mathematics confidence				
Quebec	0.38	(0.04)	0.31	0.45
Alberta	0.37	(0.04)	0.29	0.46
Newfoundland and Labrador	0.27	(0.03)	0.22	0.32
Canada	**0.25**	**(0.02)**	**0.22**	**0.28**
British Columbia	0.24	(0.03)	0.19	0.29
Manitoba	0.16	(0.02)	0.11	0.21
Nova Scotia	0.14	(0.02)	0.09	0.19
New Brunswick	0.14	(0.02)	0.10	0.18
Ontario	0.14	(0.03)	0.07	0.20
Saskatchewan	0.05	(0.03)	0.00	0.10
Prince Edward Island	-0.02	(0.03)	-0.07	0.04
Perceived ability in mathematics				
Quebec	0.32	(0.02)	0.27	0.37
Alberta	0.27	(0.02)	0.22	0.31
New Brunswick	0.23	(0.02)	0.20	0.27
Newfoundland and Labrador	0.20	(0.03)	0.14	0.25
Prince Edward Island	0.19	(0.03)	0.14	0.24
Canada	**0.19**	**(0.01)**	**0.17**	**0.21**
Nova Scotia	0.18	(0.02)	0.13	0.23
Saskatchewan	0.17	(0.03)	0.11	0.24
Manitoba	0.09	(0.02)	0.04	0.14
British Columbia	0.07	(0.02)	0.03	0.12
Ontario	0.07	(0.03)	0.02	0.13

Table B3.1 – Concluded

Average score for indices of student engagement in mathematics, Canada and the provinces

	Index average	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Mathematics anxiety				
Ontario	0.03	(0.03)	-0.02	0.09
British Columbia	0.00	(0.02)	-0.04	0.05
Manitoba	-0.03	(0.03)	-0.08	0.02
Canada	**-0.04**	**(0.01)**	**-0.07**	**-0.02**
Quebec	-0.07	(0.02)	-0.12	-0.02
Saskatchewan	-0.07	(0.03)	-0.12	-0.01
New Brunswick	-0.10	(0.02)	-0.14	-0.06
Alberta	-0.11	(0.03)	-0.16	-0.05
Nova Scotia	-0.13	(0.03)	-0.18	-0.07
Newfoundland and Labrador	-0.16	(0.02)	-0.21	-0.11
Prince Edward Island	-0.18	(0.03)	-0.23	-0.12

Note: The OECD average for all indices is 0. Provinces are sorted by average score.

Table B3.2

Difference in mathematics performance between students with high mathematics engagement compared to students with low mathematics engagement, Canada and the provinces

	Average combined mathematics score for students who are low* on the index	Average combined mathematics score for students who are high* on the index	Difference in scores (high-low)	Standard error
Belief in the usefulness of mathematics				
Prince Edward Island	457	536	79	(8.6)
British Columbia	500	575	76	(5.2)
New Brunswick	474	548	74	(5.0)
Alberta	514	587	72	(7.9)
Nova Scotia	481	551	70	(6.9)
Ontario	495	562	67	(7.3)
Canada	**504**	**567**	**62**	**(3.2)**
Saskatchewan	490	552	62	(6.5)
Manitoba	496	557	61	(8.7)
Newfoundland and Labrador	490	545	56	(8.3)
Quebec	517	560	44	(5.9)
Interest and enjoyment in mathematics				
Nova Scotia	485	566	81	(7.4)
Prince Edward Island	460	540	80	(6.9)
British Columbia	503	576	73	(5.3)
Ontario	498	569	71	(7.6)
New Brunswick	482	552	70	(6.8)
Canada	**503**	**573**	**70**	**(3.9)**
Newfoundland and Labrador	489	550	62	(7.8)
Alberta	521	582	61	(7.1)
Saskatchewan	498	549	52	(7.9)
Manitoba	503	555	52	(8.4)
Quebec	513	563	49	(8.3)

Table B3.2 – Concluded

Difference in mathematics performance between students with high mathematics engagement compared to students with low mathematics engagement, Canada and the provinces

	Average combined mathematics score for students who are low* on the index	Average combined mathematics score for students who are high* on the index	Difference in scores (high-low)	Standard error
Perceived ability in mathematics				
Prince Edward Island	449	582	134	(6.5)
New Brunswick	457	585	128	(4.7)
Manitoba	479	604	125	(8.4)
Nova Scotia	466	589	123	(6.4)
British Columbia	487	609	123	(5.5)
Alberta	502	622	120	(8.4)
Saskatchewan	472	588	116	(6.2)
Canada	**492**	**603**	**111**	**(3.0)**
Newfoundland and Labrador	468	579	111	(6.3)
Quebec	488	598	110	(5.9)
Ontario	485	586	102	(7.5)
Mathematics confidence				
Prince Edward Island	428	584	156	(8.4)
Newfoundland and Labrador	440	596	156	(8.1)
Quebec	461	612	150	(7.7)
Alberta	472	622	149	(8.1)
New Brunswick	437	583	146	(5.8)
Nova Scotia	441	585	144	(7.4)
British Columbia	471	614	143	(6.9)
Manitoba	458	599	141	(9.9)
Ontario	462	597	134	(10.0)
Canada	**478**	**611**	**133**	**(4.0)**
Saskatchewan	455	589	133	(9.6)
Mathematics anxiety				
Canada	**554**	**483**	**-71**	**(4.3)**
Newfoundland and Labrador	567	479	-88	(8.1)
Ontario	577	485	-92	(7.5)
Prince Edward Island	543	450	-93	(7.7)
British Columbia	587	491	-96	(6.7)
Saskatchewan	563	462	-101	(6.8)
Manitoba	582	480	-102	(9.7)
Nova Scotia	570	467	-103	(6.8)
Quebec	581	477	-104	(9.3)
New Brunswick	566	459	-107	(5.3)
Alberta	607	495	-112	(7.1)

* Students low on a given index are defined as those falling one standard deviation below the average.
Students high on a given index are defined as those falling one standard deviation above the average.

Table B3.3

Student engagement regression coefficients for females relative to males controlling for mathematics ability, Canada and the provinces

	Regression coefficient (females relative to males)	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Interest and enjoyment in mathematics				
Manitoba	0.09	(0.01)	0.06	0.12
Prince Edward Island	0.08	(0.03)	0.02	0.14
Saskatchewan	0.03	(0.01)	0.01	0.04
Nova Scotia	0.02	(0.01)	0.01	0.04
Newfoundland and Labrador	-0.03	(0.02)	-0.06	0.00
British Columbia	-0.06	(0.01)	-0.09	-0.03
Alberta	-0.07	(0.02)	-0.10	-0.03
Quebec	-0.10	(0.03)	-0.16	-0.05
New Brunswick	-0.11	(0.01)	-0.12	-0.09
Canada	**-0.12**	**(0.04)**	**-0.20**	**-0.04**
Ontario	-0.15	(0.02)	-0.19	-0.10
Belief in the usefulness of mathematics				
Newfoundland and Labrador	0.00	(0.05)	-0.10	0.10
Canada	**-0.06**	**(0.01)**	**-0.08**	**-0.04**
Alberta	-0.06	(0.01)	-0.08	-0.05
Manitoba	-0.07	(0.02)	-0.10	-0.03
Saskatchewan	-0.09	(0.01)	-0.12	-0.06
Nova Scotia	-0.10	(0.01)	-0.11	-0.08
Prince Edward Island	-0.10	(0.04)	-0.17	-0.03
British Columbia	-0.12	(0.04)	-0.19	-0.05
Quebec	-0.14	(0.01)	-0.16	-0.13
Ontario	-0.22	(0.01)	-0.24	-0.19
New Brunswick	-0.25	(0.02)	-0.29	-0.21
Mathematics confidence				
Quebec	-0.24	(0.04)	-0.31	-0.17
Newfoundland and Labrador	-0.25	(0.02)	-0.29	-0.20
Nova Scotia	-0.25	(0.02)	-0.29	-0.22
Ontario	-0.26	(0.04)	-0.33	-0.19
Canada	**-0.26**	**(0.01)**	**-0.28**	**-0.24**
New Brunswick	-0.27	(0.01)	-0.30	-0.25
British Columbia	-0.29	(0.01)	-0.32	-0.27
Saskatchewan	-0.31	(0.02)	-0.35	-0.27
Alberta	-0.35	(0.03)	-0.40	-0.30
Prince Edward Island	-0.36	(0.02)	-0.39	-0.32
Manitoba	-0.37	(0.02)	-0.42	-0.32
Perceived ability in mathematics				
Newfoundland and Labrador	-0.17	(0.02)	-0.21	-0.14
Saskatchewan	-0.23	(0.01)	-0.25	-0.20
Manitoba	-0.23	(0.02)	-0.27	-0.20
Prince Edward Island	-0.25	(0.01)	-0.28	-0.22
British Columbia	-0.26	(0.01)	-0.28	-0.23
Nova Scotia	-0.27	(0.03)	-0.33	-0.22
Canada	**-0.29**	**(0.01)**	**-0.31**	**-0.27**
Quebec	-0.31	(0.01)	-0.34	-0.29
Alberta	-0.31	(0.02)	-0.35	-0.28
Ontario	-0.32	(0.01)	-0.35	-0.30
New Brunswick	-0.34	(0.02)	-0.37	-0.31

Table B3.3 – Concluded

Student engagement regression coefficients for females relative to males controlling for mathematics ability, Canada and the provinces

	Regression coefficient (females relative to males)	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Mathematics anxiety				
New Brunswick	0.39	(0.02)	0.36	0.42
Nova Scotia	0.37	(0.03)	0.31	0.43
Saskatchewan	0.35	(0.02)	0.31	0.38
Ontario	0.32	(0.02)	0.29	0.35
Manitoba	0.30	(0.03)	0.25	0.36
Newfoundland and Labrador	0.29	(0.01)	0.28	0.31
Quebec	0.28	(0.01)	0.26	0.30
Alberta	0.28	(0.03)	0.22	0.34
Canada	**0.27**	**(0.01)**	**0.25**	**0.29**
Prince Edward Island	0.27	(0.01)	0.25	0.29
British Columbia	0.27	(0.01)	0.24	0.29

Note: Positive regression coefficients indicate that females score higher on a given index while negative regression coefficients indicate that males score higher on a given index.

Table B3.4

Average scores on indices of learning strategies and preferences for learning situations in mathematics, Canada and the provinces

	Index average	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Memorization/rehearsal learning strategies				
Newfoundland and Labrador	0.30	(0.02)	0.26	0.34
Alberta	0.25	(0.03)	0.19	0.31
Ontario	0.17	(0.02)	0.13	0.21
Nova Scotia	0.16	(0.02)	0.12	0.20
Saskatchewan	0.16	(0.03)	0.10	0.22
Canada	**0.16**	**(0.01)**	**0.14**	**0.18**
New Brunswick	0.14	(0.02)	0.10	0.18
Manitoba	0.13	(0.03)	0.07	0.19
British Columbia	0.12	(0.02)	0.08	0.16
Quebec	0.11	(0.03)	0.05	0.17
Prince Edward Island	0.08	(0.03)	0.02	0.14
Control strategies				
Quebec	0.33	(0.03)	0.27	0.39
Newfoundland and Labrador	0.15	(0.02)	0.11	0.19
Canada	**0.06**	**(0.01)**	**0.04**	**0.08**
Alberta	-0.01	(0.02)	-0.05	0.03
Ontario	-0.03	(0.03)	-0.09	0.03
British Columbia	-0.05	(0.03)	-0.11	0.01
New Brunswick	-0.06	(0.02)	-0.10	-0.02
Nova Scotia	-0.07	(0.02)	-0.11	-0.03
Saskatchewan	-0.08	(0.03)	-0.14	-0.02
Manitoba	-0.09	(0.03)	-0.15	-0.03
Prince Edward Island	-0.13	(0.03)	-0.19	-0.07

Table B3.4 – Concluded

Average scores on indices of learning strategies and preferences for learning situations in mathematics, Canada and the provinces

	Index average	Standard error	Confidence interval – 95% lower limit	Confidence interval – 95% upper limit
Elaboration strategies				
Nova Scotia	0.13	(0.02)	0.09	0.17
Quebec	0.12	(0.03)	0.06	0.18
New Brunswick	0.11	(0.02)	0.07	0.15
Alberta	0.11	(0.02)	0.07	0.15
Canada	**0.08**	**(0.01)**	**0.06**	**0.10**
Ontario	0.07	(0.03)	0.01	0.13
Newfoundland and Labrador	0.06	(0.02)	0.02	0.10
Prince Edward Island	0.04	(0.03)	-0.02	0.10
Manitoba	0.03	(0.02)	-0.01	0.07
Saskatchewan	0.02	(0.03)	-0.04	0.08
British Columbia	-0.02	(0.02)	-0.06	0.02
Preferences for cooperative learning situations				
Newfoundland and Labrador	0.27	(0.02)	0.23	0.31
New Brunswick	0.21	(0.02)	0.17	0.25
Ontario	0.21	(0.03)	0.15	0.27
Nova Scotia	0.18	(0.02)	0.14	0.22
Manitoba	0.16	(0.02)	0.12	0.20
Canada	**0.14**	**(0.01)**	**0.12**	**0.16**
Prince Edward Island	0.13	(0.03)	0.07	0.19
Alberta	0.12	(0.03)	0.06	0.18
British Columbia	0.10	(0.02)	0.06	0.14
Quebec	0.08	(0.02)	0.04	0.12
Saskatchewan	0.08	(0.03)	0.02	0.14
Preferences for competitive learning situations				
Alberta	0.29	(0.02)	0.25	0.33
Quebec	0.23	(0.03)	0.17	0.29
British Columbia	0.20	(0.02)	0.16	0.24
Canada	**0.19**	**(0.01)**	**0.17**	**0.21**
Newfoundland and Labrador	0.17	(0.02)	0.13	0.21
Ontario	0.17	(0.03)	0.11	0.23
New Brunswick	0.16	(0.02)	0.12	0.20
Nova Scotia	0.14	(0.03)	0.08	0.20
Saskatchewan	0.13	(0.03)	0.07	0.19
Prince Edward Island	0.08	(0.02)	0.04	0.12
Manitoba	0.06	(0.03)	0.00	0.12

Note: The OECD average for all indices is 0. Provinces are sorted by average score.

Table B3.5

Difference in mathematics performance between students with high levels of mathematics learning strategies and preferences for learning compared to students with low levels, Canada and the provinces

	Average mathematics score for students who are low* on the index	Average mathematics score for students who are high* on the index	Difference in scores (high-low)	Standard error
Memorization strategies				
Newfoundland and Labrador	505	535	30	(11.3)
Prince Edward Island	467	513	46	(13.4)
Nova Scotia	491	538	47	(7.0)
New Brunswick	490	519	29	(6.0)
Quebec	550	525	-25	(8.0)
Ontario	497	548	51	(7.4)
Manitoba	505	552	47	(9.3)
Saskatchewan	502	541	39	(9.2)
Alberta	524	569	45	(11.1)
British Columbia	518	559	41	(6.4)
Canada	**513**	**548**	**34**	**(3.8)**
Control strategies				
Newfoundland and Labrador	479	538	58	(9.3)
Prince Edward Island	462	519	56	(9.2)
Nova Scotia	481	536	54	(6.5)
New Brunswick	482	529	47	(6.6)
Quebec	514	548	33	(6.7)
Ontario	494	543	49	(9.3)
Manitoba	507	547	40	(8.8)
Saskatchewan	490	540	50	(7.6)
Alberta	529	585	56	(9.6)
British Columbia	511	563	51	(6.6)
Canada	505	553	49	(3.7)
Elaboration strategies				
Newfoundland and Labrador	496	543	47	(9.6)
Prince Edward Island	466	525	58	(11.3)
Nova Scotia	491	541	50	(7.6)
New Brunswick	483	533	50	(6.5)
Quebec	523	539	16	(8.5)
Ontario	504	550	46	(8.2)
Manitoba	513	544	30	(11.3)
Saskatchewan	503	527	25	(11.8)
Alberta	548	576	28	(12.7)
British Columbia	517	563	46	(8.9)
Canada	**509**	**552**	**43**	**(4.0)**
Preferences for cooperative learning				
Newfoundland and Labrador	518	509	-9	(8.4)
Prince Edward Island	491	500	9	(10.9)
Nova Scotia	530	504	-26	(7.5)
New Brunswick	507	508	1	(6.4)
Quebec	537	535	-3	(6.9)
Ontario	532	519	-14	(6.9)
Manitoba	530	533	3	(10.5)
Saskatchewan	519	518	-1	(7.8)
Alberta	571	551	-20	(10.4)
British Columbia	541	540	-1	(8.3)
Canada	**524**	**529**	**5**	**(4.0)**

Table B3.5 – Concluded

Difference in mathematics performance between students with high levels of mathematics learning strategies and preferences for learning compared to students with low levels, Canada and the provinces

	Average mathematics score for students who are low* on the index	Average mathematics score for students who are high* on the index	Difference in scores (high-low)	Standard error
Preferences for competitive learning				
Newfoundland and Labrador	500	540	40	(7.1)
Prince Edward Island	453	540	87	(10.3)
Nova Scotia	487	557	70	(9.5)
New Brunswick	487	538	51	(6.6)
Quebec	530	548	18	(8.3)
Ontario	507	562	55	(10.0)
Manitoba	501	566	65	(10.6)
Saskatchewan	504	550	47	(8.8)
Alberta	536	588	52	(10.4)
British Columbia	517	582	65	(6.3)
Canada	**516**	**568**	**52**	**(4.1)**

* Students low on a given index are defined as those falling one standard deviation below the mean.
Students high on a given index are defined as those falling one standard deviation above the mean.

Table B3.6

Average scores for learning strategies and preferences for learning: low achievers versus high achievers, Canada and the provinces

	Low performers on the combined mathematics scale		High performers on the combined mathematics scale	
	Index average	Standard error	Index average	Standard error
Memorization strategies				
Newfoundland and Labrador	0.26	(0.07)	0.39	(0.08)
Prince Edward Island	-0.14	(0.08)	0.20	(0.11)
Nova Scotia	-0.13	(0.06)	0.33	(0.05)
New Brunswick	0.00	(0.06)	0.17	(0.04)
Quebec	0.28	(0.05)	-0.10	(0.04)
Ontario	-0.09	(0.08)	0.39	(0.04)
Manitoba	-0.01	(0.07)	0.29	(0.06)
Saskatchewan	-0.03	(0.09)	0.33	(0.08)
Alberta	-0.07	(0.07)	0.42	(0.08)
British Columbia	-0.25	(0.08)	0.23	(0.04)
Canada	**0.00**	**(0.04)**	**0.24**	**(0.02)**
Control strategies				
Newfoundland and Labrador	-0.08	(0.06)	0.40	(0.07)
Prince Edward Island	-0.43	(0.07)	0.08	(0.09)
Nova Scotia	-0.39	(0.06)	0.14	(0.06)
New Brunswick	-0.32	(0.05)	0.11	(0.05)
Quebec	0.13	(0.06)	0.44	(0.04)
Ontario	-0.37	(0.08)	0.18	(0.05)
Manitoba	-0.32	(0.07)	0.09	(0.06)
Saskatchewan	-0.38	(0.07)	0.11	(0.07)
Alberta	-0.36	(0.07)	0.19	(0.05)
British Columbia	-0.44	(0.07)	0.18	(0.05)
Canada	**-0.25**	**(0.04)**	**0.24**	**(0.03)**

Table B3.6 – Concluded

Average scores for learning strategies and preferences for learning: low achievers versus high achievers, Canada and the provinces

	Low performers on the combined mathematics scale		High performers on the combined mathematics scale	
	Index average	Standard error	Index average	Standard error
Elaboration strategies				
Newfoundland and Labrador	0.07	(0.06)	0.29	(0.09)
Prince Edward Island	-0.05	(0.07)	0.37	(0.08)
Nova Scotia	0.05	(0.05)	0.42	(0.06)
New Brunswick	0.03	(0.06)	0.41	(0.05)
Quebec	0.33	(0.05)	0.19	(0.05)
Ontario	0.01	(0.07)	0.31	(0.05)
Manitoba	0.11	(0.07)	0.11	(0.05)
Saskatchewan	0.05	(0.08)	0.17	(0.06)
Alberta	0.06	(0.07)	0.22	(0.05)
British Columbia	-0.12	(0.07)	0.14	(0.05)
Canada	**0.09**	**(0.03)**	**0.23**	**(0.02)**
Preferences for cooperative learning				
Newfoundland and Labrador	0.34	(0.07)	0.21	(0.07)
Prince Edward Island	0.03	(0.08)	-0.03	(0.08)
Nova Scotia	0.36	(0.06)	-0.10	(0.06)
New Brunswick	0.22	(0.05)	0.02	(0.06)
Quebec	0.24	(0.06)	-0.04	(0.04)
Ontario	0.24	(0.08)	0.02	(0.04)
Manitoba	0.12	(0.07)	0.00	(0.06)
Saskatchewan	0.08	(0.07)	-0.03	(0.06)
Alberta	0.14	(0.07)	-0.04	(0.05)
British Columbia	-0.02	(0.08)	-0.06	(0.05)
Canada	**0.19**	**(0.04)**	**-0.02**	**(0.02)**
Preferences for competitive learning				
Newfoundland and Labrador	0.10	(0.05)	0.39	(0.07)
Prince Edward Island	-0.10	(0.07)	0.53	(0.09)
Nova Scotia	-0.12	(0.05)	0.58	(0.07)
New Brunswick	0.10	(0.04)	0.44	(0.06)
Quebec	0.28	(0.05)	0.27	(0.05)
Ontario	0.06	(0.08)	0.47	(0.06)
Manitoba	0.03	(0.06)	0.40	(0.06)
Saskatchewan	-0.01	(0.06)	0.44	(0.07)
Alberta	0.13	(0.07)	0.54	(0.08)
British Columbia	-0.11	(0.06)	0.53	(0.05)
Canada	**0.09**	**(0.03)**	**0.44**	**(0.03)**

Note: Low performers are defined as those who score below 420 points on the combined mathematics scale which corresponds to a proficiency level of 1 or less. High performers are defined as those who score above 606 points on the combined mathematics scale which corresponds to a proficiency level of 5 or higher.

Table B4.1

Parental educational attainment, Canada and the provinces

	High school or less	Standard error	College	Standard error	University	Standard error
Canada	**0.37**	**(0.01)**	**0.25**	**(0.00)**	**0.38**	**(0.01)**
Newfoundland and Labrador	0.53	(0.01)	0.18	(0.01)	0.29	(0.01)
Prince Edward Island	0.34	(0.01)	0.27	(0.01)	0.39	(0.01)
Nova Scotia	0.44	(0.01)	0.20	(0.01)	0.37	(0.01)
New Brunswick	0.41	(0.01)	0.23	(0.01)	0.36	(0.01)
Quebec	0.40	(0.01)	0.25	(0.01)	0.35	(0.01)
Ontario	0.31	(0.02)	0.29	(0.01)	0.40	(0.02)
Manitoba	0.43	(0.02)	0.17	(0.01)	0.40	(0.02)
Saskatchewan	0.45	(0.02)	0.17	(0.01)	0.38	(0.02)
Alberta	0.36	(0.02)	0.22	(0.01)	0.42	(0.02)
British Columbia	0.38	(0.01)	0.23	(0.01)	0.39	(0.02)

Note: Data are presented as proportions. For example, 0.37 is equivalent to 37%.

Table B4.2

Parental education and student performance in mathematics, Canada and the provinces

	Percentiles of overall mathematics performance					
	25	Standard error	50	Standard error	75	Standard error
Canada						
High School or less	**460**	**(2.40)**	**514**	**(2.72)**	**573**	**(3.17)**
College	**475**	**(2.79)**	**533**	**(2.99)**	**589**	**(2.72)**
University	**497**	**(3.57)**	**558**	**(3.22)**	**616**	**(2.95)**
Newfoundland and Labrador						
High School or less	449	(3.50)	501	(4.24)	555	(4.59)
College	477	(7.95)	532	(6.29)	580	(7.12)
University	484	(8.87)	550	(9.31)	606	(6.69)
Prince Edward Island						
High School or less	430	(5.18)	487	(5.94)	544	(4.86)
College	438	(9.14)	494	(6.23)	543	(5.70)
University	466	(5.22)	528	(4.99)	581	(5.32)
Nova Scotia						
High School or less	441	(4.83)	497	(4.74)	553	(3.94)
College	459	(5.46)	509	(5.11)	564	(6.23)
University	485	(5.77)	544	(5.55)	601	(5.88)
New Brunswick						
High School or less	438	(3.18)	493	(3.55)	552	(3.63)
College	463	(4.80)	515	(4.36)	571	(4.37)
University	471	(3.75)	531	(4.82)	588	(2.92)
Quebec						
High School or less	461	(7.47)	519	(5.53)	580	(5.65)
College	484	(9.70)	550	(7.05)	606	(6.44)
University	500	(9.41)	568	(6.13)	628	(7.49)
Ontario						
High School or less	460	(4.57)	506	(4.94)	565	(5.97)
College	471	(5.39)	525	(5.00)	580	(5.62)
University	497	(6.87)	554	(5.97)	611	(5.56)

Table B4.2 – Concluded

Parental education and student performance in mathematics, Canada and the provinces

	Percentiles of overall mathematics performance					
	25	Standard error	50	Standard error	75	Standard error
Manitoba						
High School or less	459	(6.08)	519	(4.78)	579	(6.18)
College	479	(7.49)	531	(6.35)	588	(8.35)
University	482	(6.24)	543	(5.34)	602	(5.38)
Saskatchewan						
High School or less	448	(7.17)	505	(6.10)	566	(5.38)
College	464	(10.63)	527	(6.90)	588	(9.32)
University	474	(5.59)	535	(4.78)	588	(4.49)
Alberta						
High School or less	473	(8.35)	531	(8.89)	592	(8.76)
College	493	(7.79)	547	(6.48)	606	(9.30)
University	516	(7.12)	572	(5.87)	632	(6.40)
British Columbia						
High School or less	469	(4.34)	523	(4.72)	582	(4.67)
College	477	(4.60)	534	(5.14)	593	(5.31)
University	503	(7.02)	563	(4.72)	617	(4.11)

Table B4.3

Distribution of parental education for Canadian students with high and low overall mathematics performance

	Level of parental education					
	High school or less	Standard error	College	Standard error	University	Standard error
Lowest 15% in mathematics	0.46	(0.01)	0.26	(0.01)	0.28	(0.01)
Highest 15% in mathematics	0.25	(0.01)	0.23	(0.01)	0.52	(0.01)

Note: Data are presented as proportions. For example, 0.46 is equivalent to 46%.

Table B4.4

Parental educational attainment and occupation, Canada

	High school or less	Standard error	College	Standard error	University	Standard error
Higher service	0.13	(0.01)	0.21	(0.01)	0.41	(0.01)
Lower service	0.18	(0.01)	0.31	(0.01)	0.38	(0.01)
Routine clerical/sales	0.29	(0.01)	0.26	(0.01)	0.11	(0.01)
Skilled-manual	0.18	(0.01)	0.11	(0.01)	0.05	(0.00)
Semi-unskilled manual	0.20	(0.01)	0.09	(0.01)	0.04	(0.00)
Farmers/Farm managers	0.03	(0.00)	0.02	(0.00)	0.01	(0.00)

Note: Data are presented as proportions. For example, 0.13 is equivalent to 13%.

Table B4.5

Parental occupation and student mathematics performance, Canada and the provinces

	Percentiles for overall mathematics performance					
	25	Standard error	50	Standard error	75	Standard error
Canada						
Higher service	**502**	**(3.56)**	**564**	**(3.35)**	**621**	**(3.12)**
Lower service	**487**	**(3.34)**	**544**	**(2.51)**	**601**	**(2.69)**
Routine clerical / sales	**471**	**(3.26)**	**528**	**(3.13)**	**584**	**(3.01)**
Skilled-manual	**446**	**(4.05)**	**512**	**(3.95)**	**570**	**(3.78)**
Semi-unskilled manual	**445**	**(4.12)**	**498**	**(3.64)**	**555**	**(3.99)**
Farmers / Farm managers	**484**	**(9.62)**	**545**	**(6.73)**	**608**	**(11.12)**
Newfoundland and Labrador						
Higher service	497	(8.16)	561	(8.16)	609	(9.25)
Lower service	487	(7.46)	537	(5.45)	590	(8.19)
Routine clerical / sales	462	(5.75)	510	(6.96)	564	(7.56)
Skilled-manual	439	(7.88)	500	(7.95)	553	(6.41)
Semi-unskilled manual	433	(7.73)	484	(8.36)	539	(9.38)
Farmers / Farm managers	534	(35.15)	548	(38.40)	585	(46.37)
Prince Edward Island						
Higher service	477	(10.23)	540	(9.30)	592	(8.48)
Lower service	462	(6.45)	517	(5.62)	569	(6.22)
Routine clerical / sales	444	(7.42)	500	(5.93)	549	(5.73)
Skilled-manual	415	(11.64)	477	(9.85)	534	(7.47)
Semi-unskilled manual	424	(9.65)	475	(9.55)	533	(11.32)
Farmers / Farm managers	449	(16.20)	511	(11.86)	561	(17.73)
Nova Scotia						
Higher service	488	(7.34)	545	(5.80)	599	(7.42)
Lower service	480	(4.82)	535	(5.79)	593	(6.27)
Routine clerical / sales	455	(5.22)	506	(4.94)	556	(6.47)
Skilled-manual	427	(6.92)	482	(8.38)	533	(8.67)
Semi-unskilled manual	421	(8.96)	479	(8.50)	538	(9.51)
Farmers / Farm managers	476	(34.16)	542	(34.48)	619	(68.26)
New Brunswick						
Higher service	491	(5.92)	544	(4.39)	596	(5.41)
Lower service	469	(4.90)	524	(5.19)	581	(4.44)
Routine clerical / sales	452	(4.91)	506	(4.83)	563	(6.40)
Skilled-manual	435	(6.34)	491	(6.18)	551	(6.41)
Semi-unskilled manual	423	(5.29)	477	(4.89)	535	(7.75)
Farmers / Farm managers	419	(16.89)	481	(30.25)	535	(21.04)
Quebec						
Higher service	515	(9.13)	578	(8.10)	634	(6.42)
Lower service	489	(7.94)	555	(7.88)	611	(5.98)
Routine clerical / sales	469	(9.55)	532	(7.90)	588	(6.20)
Skilled-manual	441	(10.27)	517	(9.48)	582	(8.27)
Semi-unskilled manual	448	(8.89)	503	(7.80)	559	(9.30)
Farmers / Farm managers	495	(35.05)	572	(22.96)	637	(37.12)
Ontario						
Higher service	490	(6.61)	551	(7.64)	611	(8.56)
Lower service	485	(5.56)	539	(5.88)	595	(6.60)
Routine clerical / sales	477	(5.72)	532	(6.63)	584	(5.34)
Skilled-manual	450	(8.48)	510	(6.54)	561	(7.68)
Semi-unskilled manual	447	(8.34)	496	(6.94)	552	(9.12)
Farmers / Farm managers	480	(18.63)	530	(24.39)	597	(53.13)

Table B4.5 – Concluded

Parental occupation and student mathematics performance, Canada and the provinces

	Percentiles for overall mathematics performance					
	25	Standard error	50	Standard error	75	Standard error
Manitoba						
Higher service	495	(7.58)	555	(7.50)	612	(8.52)
Lower service	479	(7.45)	539	(6.71)	594	(5.45)
Routine clerical / sales	467	(9.38)	528	(5.89)	585	(6.49)
Skilled-manual	449	(9.67)	514	(9.87)	572	(10.31)
Semi-unskilled manual	440	(8.60)	490	(9.83)	537	(9.09)
Farmers / Farm managers	473	(9.28)	525	(13.36)	585	(16.52)
Saskatchewan						
Higher service	488	(8.10)	546	(6.98)	603	(7.49)
Lower service	475	(8.03)	533	(6.16)	585	(5.56)
Routine clerical / sales	449	(11.00)	511	(8.05)	570	(8.88)
Skilled-manual	421	(11.73)	480	(10.11)	539	(15.39)
Semi-unskilled manual	416	(11.30)	471	(14.54)	537	(12.60)
Farmers / Farm managers	475	(9.84)	530	(11.77)	584	(11.36)
Alberta						
Higher service	527	(7.51)	585	(4.53)	639	(8.20)
Lower service	500	(7.84)	550	(7.55)	610	(8.47)
Routine clerical / sales	479	(10.43)	532	(11.29)	594	(10.57)
Skilled-manual	457	(16.07)	528	(14.09)	585	(11.80)
Semi-unskilled manual	446	(14.42)	510	(16.31)	568	(9.03)
Farmers / Farm managers	516	(15.26)	574	(12.93)	622	(13.29)
British Columbia						
Higher service	513	(7.23)	570	(5.57)	619	(4.76)
Lower service	491	(5.21)	549	(5.05)	605	(5.23)
Routine clerical / sales	470	(6.25)	527	(6.86)	586	(5.54)
Skilled-manual	460	(8.28)	517	(6.29)	578	(6.75)
Semi-unskilled manual	457	(9.78)	508	(8.14)	565	(8.79)
Farmers / Farm managers	499	(45.65)	560	(24.65)	602	(26.15)

Table B4.6

School socio-economic status (SES) and student performance in mathematics in Canada

	Percentiles of PISA overall mathematics performance after conditioning on individual SES					
	25	Standard error	50	Standard error	75	Standard error
Low SES schools	466	(3.61)	525	(3.40)	585	(3.53)
Middle SES schools	482	(2.38)	535	(2.50)	589	(2.71)
High SES schools	494	(3.49)	548	(3.27)	602	(3.21)

Measuring up: Canadian Results of the OECD PISA Study

The Performance of Canada's Youth in Mathematics, Reading, Science and Problem Solving

2003 First Findings for Canadians Aged 15

The Program for International Student Assessment (PISA) is a collaborative effort among member countries of the Organisation for Economic Co-operation and Development. In Canada, PISA is administered through a partnership of the Council of Ministers of Education, Canada, Human Resources and Skills Development Canada and Statistics Canada.

This program is designed to assess, on a regular basis, the achievement of 15-year-olds in reading, mathematical and scientific literacy through a common international test. Canada and 40 other countries participated in PISA 2003, which had a special focus on mathematics. About 28,000 15-year-olds from more than 1,000 schools took part in Canada.

This report provides results of the PISA 2003 assessment of student performance in mathematics, reading, science and problem solving at the provincial level and compares the achievement of Canadian students to that of students internationally.

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